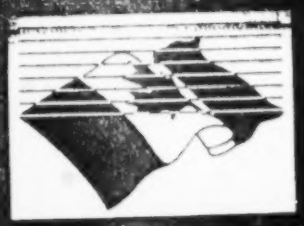
National Defence / Défense nationale

RESEARCH DEVELOPMENT AND TRAINING

IN CHEMICAL AND BIOLOGICAL DEFENCE WITHIN THE DEPARTMENT OF NATIONAL DEFENCE AND THE CANADIAN FORCES

A Review
by
William H. Barton



Ottawa, Canada, December 31, 1988

Canada

ACKNOWLEDGEMENTS

The subject matter of chemical and biological defence is technically complex and impinges on almost every aspect of defence policy and operational activity. It also has important foreign policy implications. The conduct of a review of this area of defence activity in the relatively short period of five months was possible only because I received understanding support and assistance from everyone I approached for help.

I should like to mention in particular, Mr. E.J. Healey, the Assistant Deputy Minister (Materiel), Dr. D. Schofield, Chief of Research and Development, and Dr. R. Heggie, Associate Chief of Research and Development, Department of National Defence, who were responsible for facilitating the conduct of the Review.

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William H. Barton Ottawa, Canada,
December 31, 1988

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INTRODUCTION

The introductory section of the Terms of Reference for this Review (see Appendix A), defines the objective in the following terms:

"The aim of this review is to ensure that all research, development and training activities in chemical and biological defence undertaken by the Department of National Defence are, in fact, defensive in nature and are conducted in a professional manner with no threat to public safety or the environment..."

My approach in carrying out the Review has been to seek to confirm, or otherwise, that the programs of the Canadian Government in the fields of chemical and biological defence are consistent with the policies and objectives set out in the Terms of Reference, and that its undertakings to the Canadian public are being fulfilled in the manner to be expected of a good corporate citizen.

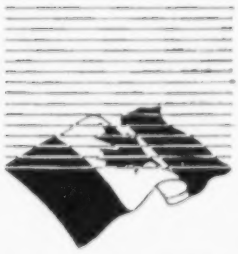
The method followed has been to proceed from first principles, starting with the guiding statements of government policy. In the first instance I have sought to ascertain that the directives and management systems for each component of the overall program are based on established policy, are comprehensive and clear, and have built-in verification safe-guards. The institution of effective management systems is of particular importance in ensuring that the government's guidelines are respected on a continuing basis. The individual components of the program are then examined, taking into account these underlying requirements, to confirm that they are consistent with the government's objectives and are being carried out in accordance with system guidelines.

At the outset I read as many as possible of the letters and other representations made to the government about the Canadian Government's activities in the field of chemical and biological defence. It is apparent that these activities are viewed with deep suspicion by many concerned citizens, both as to intent and as to public safety. In the course of the Review I have attempted to address these concerns by commenting frankly on what I learned, and seeking to answer the question, "why" as well as "what" and "how". I am under no illusions that my conclusions will find universal acceptance, but I am satisfied the facts are reported as I found them, and that the facts speak for themselves.

I did not attempt to contact directly the individuals and groups who had communicated their views to the Minister of National Defence. The task assigned to me was to conduct a review of the policy and programs of the Department of National Defence, not to conduct a Commission of Inquiry. Such a commission would have been necessary if I were to attempt to solicit views from the general public, the more so because those views would undoubtedly raise issues extraneous to my current mandate.

With a view to readability, and in order not to obscure the principal points emerging from the Review, detailed documentation and supporting data have been placed in appendices.

WHY CHEMICAL AND BIOLOGICAL DEFENCE PROGRAMS?



PANDORA'S BOX IS OPENED

An essential first step in undertaking a review of the government's policies and programs related to chemical and biological warfare is to consider the history and nature of this subject as it has evolved up to this time. Although historians quote examples of the use of chemicals as weapons of war even in ancient times, their entry into the lexicon of modern warfare dates from the Battle of Ypres, in 1915, when chlorine gas was released by the Germans against Allied troops, including the Canadians, with deadly effect.

During the remainder of the war both sides waged chemical warfare, and used chlorine, phosgene and mustard gas, on a number of occasions. Nevertheless, it was apparent to both the Germans and the Allies that once the element of initial surprise was overcome, and protective measures were available, chemical warfare proved to be of diminishing value. On the one hand, by their very nature, chemical agents were unpredictable in effect and could not be relied upon to ensure a decisive advantage on the battlefield. On the other hand, the protective measures, their use necessitated, were as much an impediment to the attacker as to the defender.

BETWEEN THE WARS

Ever since World War I, the perception of chemical agents as horror weapons which are morally reprehensible has remained firmly in the minds of governments and peoples the world over. The banning of the use of chemicals was one of the first issues addressed by the newly-established League of Nations, and in 1925, a protocol was adopted at Geneva forbidding the use in war of asphyxiating, poisonous or other gases, as well as bacteriological methods of warfare (see Appendix B).

Notwithstanding the Geneva Convention, history records that chemical agents were used on various occasions between the wars. Italy, for example, is known to have used chemical agents in Ethiopia in 1936, and in the course of doing so, demonstrated that whatever the limitations of such materials when employed against well-equipped and trained troops, against poorly prepared troops they could be decisive. This was further borne out by the Japanese experience in China during the period from 1937 to 1941. The Japanese reportedly used biological as well as chemical agents in their China campaign.

WORLD WAR II

Apart from the incidents in China, mentioned above, neither chemical nor biological agents were used in World War II. During the nineteen-thirties the Germans developed a deadly new group of chemical agents, the so-called nerve agents, which they kept in their arsenal for the whole of the war. It is fortunate for the Allies that nerve agents were never used, because our forces

learned of their existence only in 1945. Whether it was the threat of Allied retaliation, or the conviction of the German General Staff that the drawbacks associated with chemical warfare outweighed any potential military advantage to be gained by using new agents is an unresolved question. It is doubtful that the German Government's commitment to the Geneva Protocol weighed heavily in its calculations.

POST-WAR SITUATION

Fortunately, in spite of the large number of small, and not-so-small wars that have taken place since 1945, the world, until recently, has been relatively free from the use of chemical or biological weapons. There have been allegations that chemical weapons were used by the Egyptians in Yemen in the nineteen-fifties, by the Ethiopian Government against the Eritrean rebels, by Libya against Chad, by the USSR in Afghanistan, and by the Vietnamese in Laos and Cambodia. In none of these cases, however, was the impact more than local.

Recent developments however, have changed the situation dramatically. Modern chemical and biological (CB) weapons, particularly if used against personnel with inadequate protective systems, might be more predictable in their behaviour and have a more significant tactical impact than was once the case. The extensive employment of chemical weapons by Iraq, despite its accession to the Geneva Protocol, is credited with defeating the human-wave attacks favoured by the Iranian Revolutionary Guards. There is also ample evidence that Iraq used chemical agents against its Kurdish minority population. Iran, for its part, is also reported to have utilized chemical agents in retaliation against the Iraqis, although at the time of its accession to the Protocol it did not reserve to itself the right of retaliation.

The difficulty in legislating and policing a ban on the use of chemicals in war is compounded by the fact that chemical agents are relatively easy to make. Indeed, some of the most toxic agents are quite similar to insecticides. The agents used by the Iraqis with such devastating effect, against civilians as well as Iranian soldiers, were reported to have been made in a converted insecticide plant. Not without reason some observers have described chemical weapons as the "poor countries' nuclear weapons". For these reasons it was deemed prudent that the Canadian military personnel participating in peacekeeping operations along the Iran-Iraq border be equipped with CB defensive equipment. Common sense leads also to the conclusion that such agents could well have appeal to determined terrorists.

Some governments, including in particular the USSR and the United States, have concluded that without prejudice to their "no first use" commitments, under current circumstances they must maintain a retaliatory capacity to utilize chemical agents. Iraq and Iran obviously have them, and some other third-world nations are also believed to hold stocks of such weapons. Most governments, including Canada, while eschewing the possession of chemical weapons, have recognized that they must maintain a defensive capacity against the possibility of their use.

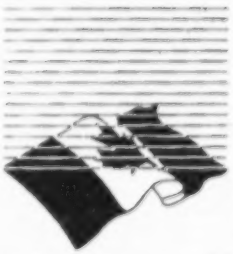
POSTWAR CB DISARMAMENT NEGOTIATIONS

It has long been recognized that the Geneva Protocol is deficient in that it deals only with the use, and not with the development, manufacture, or stockpiling of chemical and biological weapons. After World War II the United Nations included chemical and biological weapons, along with nuclear weapons, in the category of "weapons of mass destruction" and in 1968 took up the challenge of attempting to obtain agreement for the adoption of global, comprehensive and verifiable treaties to ban them. After twenty years of on-and-off effort, some progress has been made. A draft text of a treaty to ban chemical weapons is under discussion, and the fact that the USSR has finally acknowledged that it has a substantial arsenal of chemical weapons is helpful to the advancement of the negotiations. But the goal is a treaty that is "global, comprehensive and verifiable", which to say the least, is a tall order. As yet there is no satisfactory solution to the complex problem of verification. Reliable verification would involve highly intrusive and costly inspection procedures in the chemical industries of all nations party to the treaty. Many potential chemical agents are materials, or variants of them, used in normal peacetime industry. As was demonstrated in Iraq, modern chemical plants can be converted to agent manufacture and can produce militarily significant quantities of agents in a matter of weeks. Moreover, the draft treaty provides that countries may maintain up to 1000 kilograms of agents for research purposes. Thus, there can be no assurance that a treaty with credible verification provisions, acceptable to all nations, will be forthcoming in the near future. I speak from personal experience, having served as the Canadian negotiator in Geneva from 1972-1976.

There does exist (see Appendix C) a United Nations Convention banning biological weapons, adopted in 1972, to which most member governments have adhered, but it lacks effective provisions for verification. The fact that governments were prepared to accept this lacuna is generally ascribed to the impossibility of developing

practical verification procedures. It is also evidence of a general view, at the time the Convention was negotiated, that the potential military advantage of the use of biological agents in warfare, at least among technically advanced states, was moot. In recent years scientific advances, particularly in biotechnology, have greatly increased the possibilities of biological agents as potential threats. New materials may be created that could be more predictable in their effect, could be limited to an identified target area, and potentially could circumvent or penetrate some types of protective equipment. No government admits to the possession of biological weapons, but no government with the capacity to maintain defensive measures against them, has been prepared to abandon such measures.

DEFENCE AGAINST WHAT?



Without detracting in any way from the dangers CB agents would present if they were to be employed in warfare, there is in the public mind an aura of mystery about such agents which is not merited. Many are common industrial chemicals or variants of them. The biological materials currently considered usable as agents are well known to those concerned with public health and preventive medicine. The principal classes of agents are outlined below.

CHEMICAL AGENTS

Choking Agents

To launch the first gas attack in World War I, the Germans simply took cylinders of an industrial chemical, chlorine, waited until the wind was right, and opened them up so that the gas drifted downwind on the hapless Allied soldiers. Allegedly, on that occasion the troops urinated on their handkerchiefs and held them over their noses and mouths. More effective help was quick in coming, and rudimentary masks were soon provided. Chlorine was followed by phosgene, another industrial chemical, but it was stopped by the mask just as effectively. Both of these agents attacked the lungs, and all that was required to counter them was a device to filter the air the soldier breathed.

Blood Agents

This group of agents includes such compounds as hydrogen cyanide and cyanogen chloride, which interfere with the utilization of oxygen by the body tissue. The French used these agents during the First World War prior to the appearance on the scene of mustard gas, but they were abandoned because their lightness relative to air made it difficult to predict cloud travel.

Vesicants

The next agent the Germans came up with was mustard gas. It was so named by the British soldiers because they thought it smelled like mustard. The French called it yperite, presumably as a grisly tribute to Ypres, where it was first used. Mustard gas is a liquid at normal temperatures and pressures, and is disseminated in this form or in tiny droplets (an aerosol), which cause blistering when they come in contact with the skin. The vapour from the evaporating drops also causes irritation and blistering, and of course, if it is breathed, has the same effect on the respiratory organs. The eyes are also particularly vulnerable. Thus the respirator, together with chemically-resistant clothing, are essential protective equipment for the armed forces. Mustard gas, and similar substances such as lewisite, are known as vesicants because of their blistering action.

Vesicants are different from choking agents in that they persist in the environment for some weeks, and can constitute a hazard many days after delivery. Contamination, whether on a soldier, on his equipment, or on the ground, can only be removed by a procedure of decontamination. The original decontaminating agent was chlorine bleach, and many modern decontaminating agents continue to be based on bleach-type chemicals.

Nerve Agents

Nerve agents are usually liquids, and can be disseminated as such, as aerosols or as vapours. They are absorbed through the respiratory system, the skin, and the eyes. They are so named because they attack the nervous system causing a partial paralysis of the motor nerves, which can cause death in a few minutes. Even in very low concentrations nerve agents affect the vision, causing constriction of the pupil of the eye (miosis), which can severely inhibit the ability of military personnel to function effectively. The standard treatment for nerve agent poisoning is the administration of atropine and an oxime by injection. An anti-convulsant may also be included. The treatment must be given quickly if it is to be effective because the nerve agents act rapidly. The problem is to detect the gas so that protective equipment can be donned in the short time available. Protection against nerve gases is provided by the respirator and special protective clothing.

There are two principal classes of nerve agents, the so-called V agents and G agents. The V agents, which include VX, are persistent. They evaporate slowly and could pose a hazard in the environment for some time after delivery. On the other hand, the G agents such as tabun, sarin and soman (also known as GA, GB and GD respectively) are only semi-persistent. They evaporate relatively rapidly and do not pose a long term hazard. Nerve agents can be destroyed by most of the same decontaminating agents used to neutralize vesicants.

Other Agents

Agents in this category include DM (adamsite), which produces sneezing, nausea and vomiting, and a variety of other chemicals, such as CS (commonly referred to as tear gas), which have an intensely irritating effect on the eye and upper respiratory tract. These agents are used primarily by police and other security forces concerned with crowd control. In addition, military forces frequently use these compounds for chemical defence training purposes. The respirator provides complete protection.

New Compounds

In recent years advances in organic chemistry and biotechnology have led to concern that an agent or agents might be found which could defeat the protective capacity of the modern respirator, or at least reduce significantly the length of time the protection would be effective. The testing of new categories of compounds to ascertain both the effectiveness of our protective equipment and our ability to detect agents and decontaminate personnel and equipment, is an important component of the Canadian CB defence program.

BIOLOGICAL AGENTS

The agents traditionally considered as candidates for employment in biological warfare are infectious organisms (pathogens) known to attack people, animals or vegetation. They would be disseminated as solid or liquid aerosols, which would infect humans or animals when inhaled, drunk in contaminated water, or eaten. Plant life would be infected by contact. In addition to infection by direct exposure, the disease might also be transmitted from one infected person or animal to another, which would mean that under suitable conditions only a very small quantity of the pathogen would be needed to infect a large area. Most naturally-occurring biological agents are adversely affected by sunlight, by some atmospheric chemicals, and by weather conditions, so their actual effectiveness could be expected to be far below their potential.

The usefulness of biological agents as weapons of war has always been questioned. The users would be faced with the problem of ensuring the protection of their own forces, and probably also the civilian population in the area. If extensive public health measures were required, it would be difficult to achieve surprise. Biological warfare agents are relatively slow to act, which means that whatever value they might have would be in a strategic rather than a tactical role. Their targets would have to be those which would be vulnerable to long-term effects, as for example military forces in rear areas or civilian populations. There is general agreement on the most likely candidates for use as biological warfare agents, including the organisms which cause anthrax, undulant fever, psittacosis, and tularemia (rabbit fever), and toxins such as botulinus and ricin. The standard protective equipment provides protection against these agents, if their presence is known. The development of better detectors is still an important area of research.

Recent developments in biotechnology have opened up the possibility of the development of

new agents which may not be subject to some of the disadvantages of naturally-occurring pathogens and toxins, and for which existing protective equipment and detection capacity would be ineffective. Moreover, the distinction between chemical and biological agents is becoming blurred adding significantly to problems of detection and identification. Elucidation of the mechanisms of virulence and toxicity so that new agents can be identified, and methods designed to detect them and develop protection against them, is a daunting challenge facing our research and development establishments.

BIOLOGICAL - CHEMICAL WARFARE SPECTRUM

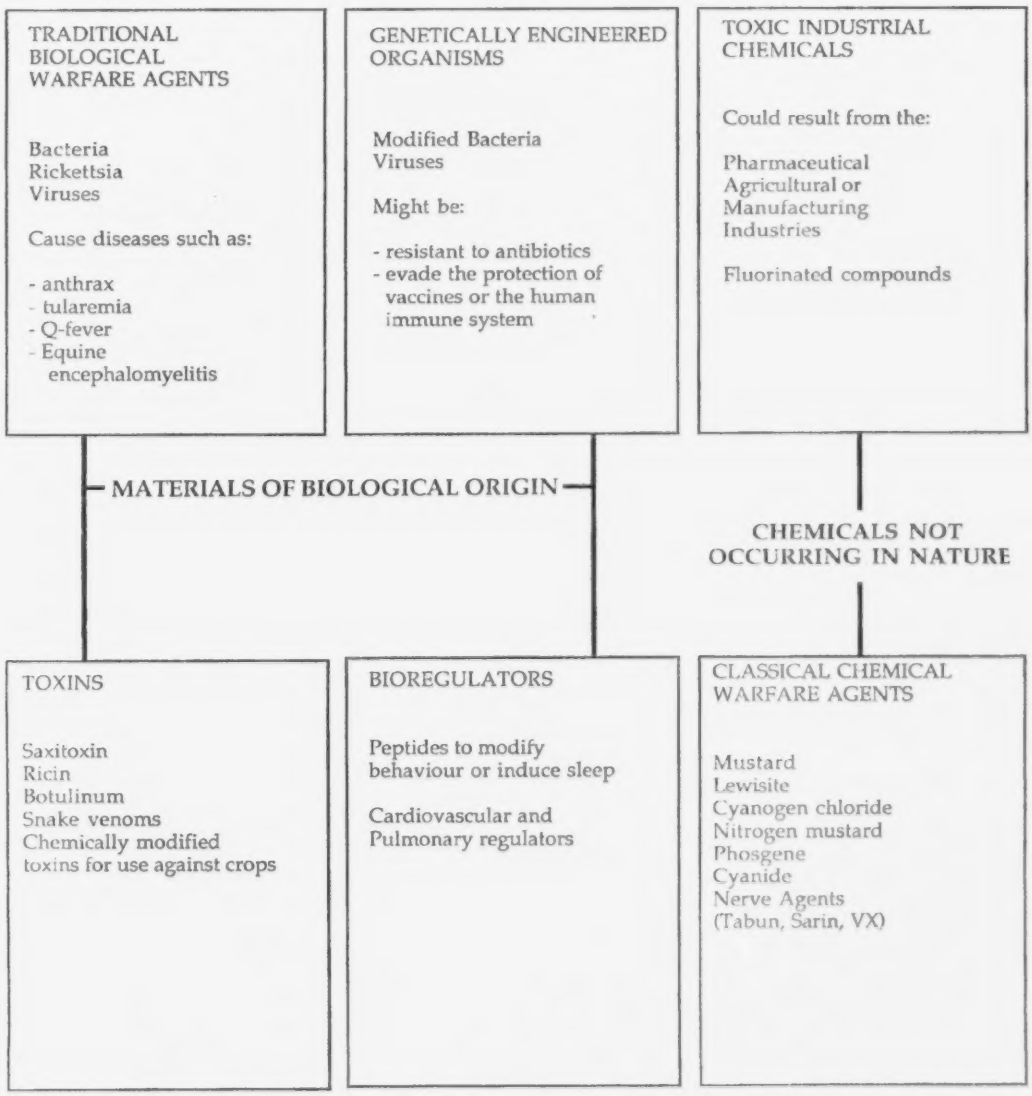
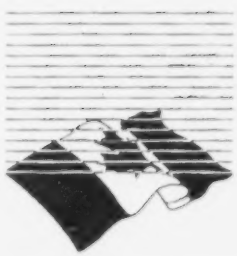


FIGURE I

CHAPTER III

CANADIAN POLICY



THE GENEVA PROTOCOL

The policy of the Canadian Government with respect to chemical and biological warfare stems from three international commitments. The first of these commitments was made in 1930, when Canada, subject to certain reservations, adhered to the "Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare", commonly known as the Geneva Protocol of 1925 (see Appendix B). The Canadian reservations were that the Protocol was binding only as regards relations with other parties to the Protocol, and that it would cease to be binding in regard to any enemy states whose armed forces or allies did not observe the provisions of the Protocol. Many other countries made the same reservations. Despite the Canadian reservation regarding the right of retaliation, Canada had no military CB program, defensive or retaliatory, before the outbreak of World War II, except for a small respirator development program initiated by General McNaughton at the National Research Council in the nineteen-thirties.

With the onset of the war the situation changed dramatically. Although committed to its obligations under the Geneva Protocol, the government decided that it had to be in a position to provide adequate defensive equipment for its forces, and to be able to retaliate if the enemy resorted to the use of CB agents. With the full support of the Canadian scientific community in the universities and industry, a full-scale program was launched. A laboratory and a respirator assembly plant were established in Ottawa and an energetic program of protective equipment development was launched.

The loss of the British-French experimental testing range in Algeria in 1940 led to the establishment of a joint Canadian-British experimental station at what is now known as Canadian Forces Base (CFB) Suffield, near Medicine Hat, Alberta. Two chemical mortar companies were trained, more than 3000 tons of mustard gas were manufactured at Cornwall and an operational reserve of the agent was stored at Suffield to be available in case of necessity. A biological defence research program was initiated at Queens University.

At the end of World War II the priority attached by the Canadian Forces to the CB program diminished and chemical munitions were dropped from operational holdings. The laboratories in Ottawa and the experimental establishment at Suffield were taken over by the newly-established Defence Research Board, and the focus of the research program took on a long-term character. Although field testing of munitions continued for some years, the emphasis was on hazard definition and defensive measures.

1971 POLICY STATEMENT

The second Canadian commitment with regard to chemical and biological warfare took the form of a policy statement made by the Canadian Representative to the First (Disarmament) Committee of the UN General Assembly on November 16, 1971, after a thorough review by the Government. The statement echoed and amplified one made in the Conference of the Committee on Disarmament, in Geneva, on March 24, 1970, and read as follows:

> "The Government of Canada intends to contribute fully to the efforts of the United Nations and of the Conference of the Committee on Disarmament to reduce and, if possible, eliminate the possibility of chemical and biological warfare. Canada intends to participate actively in negotiations towards agreements which would supplement and strengthen the Geneva Protocol of 1925 by prohibiting the development, production and stockpiling of chemical and biological weapons. Practical progress need not wait until the conclusion of these negotiations. The Protocol can be strengthened significantly through unilateral declarations of policy and intentions on the issues involved. For this purpose the Government of Canada wishes to make known its attitude toward chemical and biological warfare.
>
> 1. Canada never has had and does not now possess any biological weapons (or toxins) and does not intend to develop, produce, acquire, stockpile or use such weapons at any time in the future.
>
> 2. Canada does not possess any chemical weapons other than devices of the type used for crowd and riot-control purposes in many countries. Canada does not intend at any time in the future to use chemical weapons in war, or to develop, produce, acquire, or stockpile such weapons for use in warfare unless these weapons should be used against the military forces or the civil population of Canada or its allies. The latter condition is in accordance with the reservations Canada entered at the time of our ratification of the Geneva Protocol of 1925. We would consider formally withdrawing our reservations if effective and verifiable agreements to destroy all stockpiles and prevent the development, production and acquisition of chemical weapons can be concluded. "

The Canadian Representative concluded his statement with the following observation:

> "I believe it is quite clear that this statement applies to all chemical and biological agents whether intended for use against persons, animals or plants. "

BIOLOGICAL AND TOXIN WEAPONS CONVENTION

The third commitment arises out of Canadian ratification of the "Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction", of 1972 (see Appendix C). It is encompassed in the 1970 statement of policy cited above.

DEPARTMENT OF NATIONAL DEFENCE POLICY

The Policy of the Department of National Defence relevant to CB defence is set out in Policy Directive No. P3/85 (see Appendix E), which also encompasses nuclear defence. It reiterates government policy as cited above, and asserts that since under present world conditions the Canadian Forces may be committed to participate in a war where nuclear, biological or chemical weapons are used, they "will be prepared to take the appropriate protective measures to defend the Canadian Forces. As a result, the Canadian Forces will continue to study and develop the knowledge necessary to ensure that defensive measures are adequate. "

PROGRAM POLICY

The over-all chemical and biological defence programs of the Department of National Defence are shaped to respond to the military requirements of the Canadian Forces, which in turn are designed to respond to the missions assigned to them by the government. These missions are set out in the White Paper on Defence issued in 1987. Policy Directive P3/85 (see above) sets out the operative guidelines for CB defence. The Deputy Chief of the Defence Staff is assigned responsibility for implementation of the policy, including:

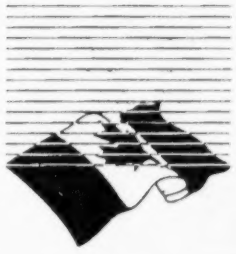
- equipment for NBC (nuclear, biological and chemical) defence;
- provision of protective equipment to personnel
- training instructions for NBC defence;
- instructions pertaining to research and development;
- intelligence;
- medical aspects of NBC defence;
- NBC weapons or component disposal;

- detection, warning, and status reporting; and
- security classification guides.

The chemical and biological defence programs incorporate three major components: research and development, the design and production of defensive equipment to meet the needs of the Canadian Forces, and training of the Canadian Forces in defensive measures. The product of the program is also available to meet civil defence needs as determined by the responsible government organization, "Emergency Preparedness Canada. "

CHAPTER IV

RESEARCH AND DEVELOPMENT PROGRAM



The Chief of Research and Development (CRAD), at National Defence Headquarters (NDHQ), is responsible for the research and development programs carried out by or on behalf of the Defence Department (except for operational research, some aspects of personnel research and some engineering development). The total CRAD budget in 1987/88 was $236.9 million and accounted for approximately 2.2% of the defence budget. The CRAD budget was broken down into $74.4 million for personnel costs, $23.2 million for the operationand maintenance of six defence research establishments and $139.3 million for capital. The majority of this last amount was applied to contracting of research and development to industry, universities and other government departments. The CRAD branch had some 1700 continuing employees, both civilian and military, of whom about 900 were employed directly on the conduct of the technical program.

The chemical and biological defence program is only one component of the overall CRAD program, and must compete for resources based on assessments made every year as to relative priorities and budgetary limitations. In 1987/88 about 11% of those employed directly on the program were allocated to CB defence, along with 2.2% of the capital budget of which some two-thirds was utilized for contracts to industry and universities.

The shaping of the CB defence research program is an integrative process, combining the ideas of individual scientists, discussions between scientists and military personnel, and consultations at conferences, national and international.

Some projects, known as technology base work, originate in the research establishments, and tend to be more fundamental studies dealing with longer-term problems related to the equipment or requirements of the Canadian Forces (CF). Other projects are usually undertaken on behalf of, and by arrangement with, an engineering directorate at National Defence Headquarters which requires a particular problem to be studied or a particular equipment to be developed. This work is approved by CRAD Headquarters, which also provides any necessary funding.

The product of this process is put into program form by way of a series of consultative committees with representation from the research and development staffs, and the operational staffs of the forces. These committees provide assurance that the projects to be undertaken are shaped to meet the operational requirements of the Canadian Forces and comply with the policy direction set out in Policy Directive P3/85, (see Appendix E).

The program is then reviewed by the department's Program Control Board for compliance with departmental funding plans, and by the Defence Management Committee to ensure adherence to departmental policy guidelines, before being submitted to the Minister of National Defence for inclusion in the departmental

ORGANIZATION FOR CHEMICAL / BIOLOGICAL DEFENCE RESEARCH

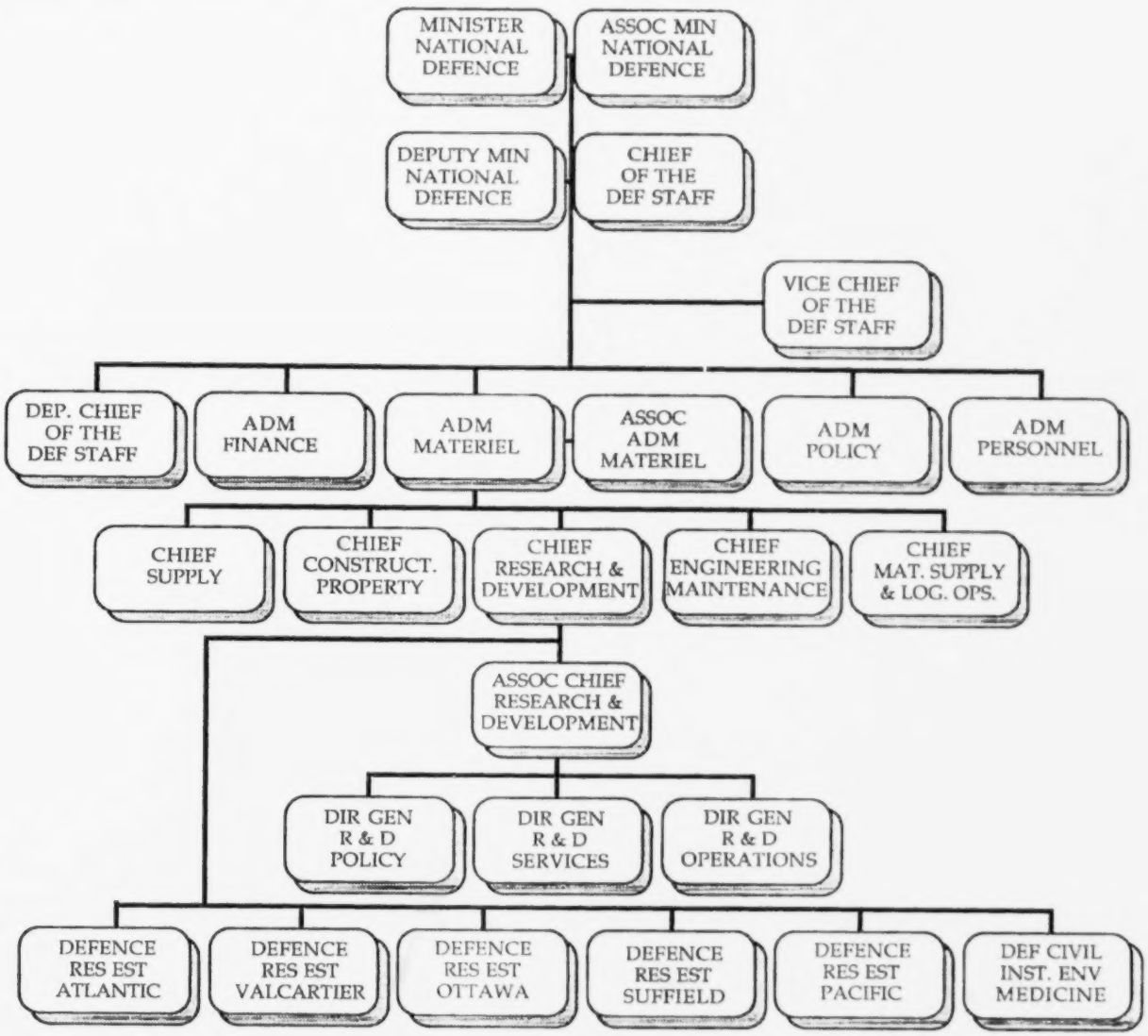

MINISTER NATIONAL DEFENCE
ASSOC MIN NATIONAL DEFENCE
DEPUTY MIN NATIONAL DEFENCE
CHIEF OF THE DEF STAFF
VICE CHIEF OF THE DEF STAFF
DEP. CHIEF OF THE DEF STAFF
ADM FINANCE
ADM MATERIEL
ASSOC ADM MATERIEL
ADM POLICY
ADM PERSONNEL
CHIEF SUPPLY
CHIEF CONSTRUCT. PROPERTY
CHIEF RESEARCH & DEVELOPMENT
CHIEF ENGINEERING MAINTENANCE
CHIEF MAT. SUPPLY & LOG. OPS.
ASSOC CHIEF RESEARCH & DEVELOPMENT
DIR GEN R & D POLICY
DIR GEN R & D SERVICES
DIR GEN R & D OPERATIONS
DEFENCE RES EST ATLANTIC
DEFENCE RES EST VALCARTIER
DEFENCE RES EST OTTAWA
DEFENCE RES EST SUFFIELD
DEFENCE RES EST PACIFIC
DEF CIVIL INST. ENV MEDICINE

FIGURE II

estimates and ultimate approval by Parliament.

After the program is approved, the system for control of implementation comes into play. The control of projects starts with the individual scientist who completes task sheets when required for each sub-element of the projects he or she is responsible for. These documents describe the work completed in the previous reporting period and the work goals for the next. The task sheets are reviewed by the Group Head, Section Head, and the Division Director before they are published in the annual or semi-annual report of the research establishment. Requests for funding of projects are made by the chief of the establishment to CRAD Headquarters.

This review process and the careful scrutiny of task sheets ensure that several levels of management are aware of the work being undertaken. The project sheets show that each scientist is committed to various tasks and it is highly improbable that any unauthorized work could be done.

Canada has arrangements for international cooperation and the exchange of information in the field of CB defence through its membership in NATO, and in memoranda of understanding with a number of individual NATO countries, as well as with Australia, New Zealand, Switzerland and Sweden. The exchanges of information which are made possible under these agreements are valuable in themselves and make possible the allocation of areas of primary responsibility which help in making the most effective use of available resources. Further, more detailed information on international agreements is contained in Appendix D to this Review. Some governments insist that the texts of such arrangements, or their terms, remain confidential, and Canada is obligated to respect their wishes. However I have examined all of these agreements, and the reports of work being done under their aegis, and I am satisfied that they are strictly limited to defensive activities.

A further dimension of Canada's international research involvement, with which I had personal experience when I was the chief Canadian disarmament negotiator in Geneva, has been the continuing involvement of the research staff of the Department of National Defence in support of this activity. Defence scientists provide specialist papers as well as technical advice and support to Canadian delegations in the negotiations, and thus help to further the attainment of a convention banning chemical weapons.

Research in chemical and biological defence is carried out at the Defence Research Establishment Suffield (DRES), Ralston, Alberta, and the Defence Research Establishment Ottawa (DREO), just outside Ottawa, Ontario. In addition, some projects are carried out at the Defence and Civil Institute of Environmental Medicine (DCIEM), Downsview, Ontario, and under contract in Canadian industry, at Canadian universities, provincial research organizations, and the Royal Military College.

DREO has been in existence (under a variety of names over the years) since the nineteen-thirties, when it developed the first Canadian facility for making respirators for the Canadian Forces. The CB programs at DREO (which form only a small part of its current research activities) are concerned primarily with research and development of protective equipment.

DRES (then called Experimental Station, Suffield) was established in 1941. DRES's programs cover all aspects of CB defence except those related to individual and collective protection. It is responsible for hazard assessment, detection, decontamination, the medical aspects of chemical defence, and biological defence (except masks and clothing). It also carries out the field trials and related research for which its very large range has made it eminently suitable.

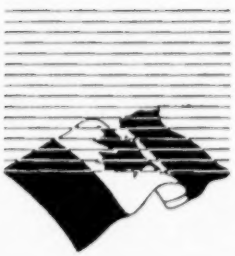
DCIEM had its origins in the Interdepartmental Committee on Aviation Medicine Research, formed in 1939 by the Department of National Defence, the National Research Council and the Department of Transport. The mission of DCIEM is to conduct research and development to provide training and environmental expertise to ensure that the human can function effectively in all environments, including one in which chemical or biological warfare agents are encountered.

In 1986, at the direction of CRAD, a major refocussing and reorganization of the program was launched, with a view to completion by 1992.

The ultimate aim of the research and development program is to enhance and ensure the capability of the Canadian Forces to operate under the conditions which would exist if they were exposed to chemical or biological agents. The planned reorganization aims at consolidating the whole of the program at Suffield. The areas of emphasis in the new consolidated program are CB Threat/Hazard Assessment, Detection and Hazard Management (including Decontamination), Biomedical Aspects of CB Defence, and CB protection. The transfer to Suffield is complete except for CB Protection.

CHAPTER V

DEFENCE RESEARCH ESTABLISHMENT SUFFIELD (DRES)



HISTORICAL BACKGROUND

In 1941 the fortunes of the Western Allies were at a low ebb. France had fallen, invasion of Britain was still seen as an imminent danger, and the possibility that Germany might resort to the use of gas against the beleaguered British Isles was viewed as a real threat. The British had just lost the use of the experimental station they operated jointly with the French in Algeria, so the Canadian Government responded willingly to a British proposal to establish in Canada a joint chemical warfare experimental facility large enough to carry out experiments in the field without danger to neighbouring communities. A tract of about 1000 square miles of land, northwest of Medicine Hat was expropriated and within a matter of months "Experimental Station, Suffield" was a functioning establishment. During the next four years an intensive program of research and field trials was carried out at Suffield, involving the controlled release of large quantities of chemical agents and the participation of hundreds of volunteers from the armed forces. The tests were designed on the one hand to support the retaliatory capacity of the Allies in case chemical or biological warfare was initiated by the Axis Powers, and on the other to ensure that protective equipment for our forces was of a high quality and adequate to meet the perceived threat. The large range area was also used for the training of two Canadian chemical mortar companies and for the storage of wartime reserves of chemical agents, primarily mustard gas. Although the need to meet military requirements was paramount, possible civilian applications of the research program were not ignored and valuable work on the use of aerial sprays for agriculture was carried out with the cooperation of the Department of Agriculture.

At the end of World War II the British withdrew from the wartime partnership, and responsibility for Suffield was passed to the newly-formed Defence Research Board (DRB). The focus of the research program became long-term in character and laboratory facilities were improved. In the immediate post-war period primary emphasis was placed on assessing the hazards posed by what at the time were seen as revolutionary new agents, the nerve gases, and the field-testing of chemical munitions, including some captured from the Germans. Extensive trials were carried out, in some of which human volunteers participated to test equipment and procedures, and to take part in training exercises. As time progressed and progress was made in developing an effective defence against nerve agents, the size and scope of the trials were reduced, and smaller quantities of agent and fewer human volunteers were required. During the past twenty years field testing with chemical agents has been limited to the small quantities required for testing defensive equipment and the occasional military exercise aimed at confirming the training level of person-

nel of the Canadian Forces. In the forty-seven years of its existence DRES has built up an unmatched reservoir of knowledge, not only of chemical and biological agents, but more particularly, of the behaviour of liquids, gases and aerosols released in the outside atmosphere. Research scientists at DRES have published many papers in scientific journals, and the information available at Suffield is of great value to environmentalists, meteorologists, public health authorities and industrial chemists. It should be noted that the research and development program of DRES is not solely devoted to CB defence. It was diversified many years ago to include quite unrelated defence research activities in order to take advantage of the high quality of the test facilities and the very large safety areas. In 1971, Canadian Forces Base Suffield was established and assumed responsibility for the whole area. DRES became a tenant and was allocated a section of the range (about 500 sq. km.) for its work. This area is known as the Experimental Proving Ground. The balance of the range was made available to the British Army for armoured training. Controlled access to the area has also been granted to the Alberta Energy Company to develop the large oil and gas reserves available, and to the Prairie Farm Rehabilitation Agency for periodic grazing of cattle. The range area is also of considerable archaeological interest and arrangements have been made for "digs", and for safeguarding certain historically significant sites. In 1974, Defence Research Establishment Suffield was made responsible to the Chief of Research and Development at National Defence Headquarters.

ORGANIZATION AND WORK OF DRES

DRES is headed by a chief, who is responsible to CRAD. Under the chief, the establishment is organized into a Defence Sciences Division, a Defence Technologies Division, a Program Support Office (the responsibilities of which include field operations), and an Administrative Division. There is also a medical adviser, responsible to the chief. The programs carried out at Suffield are as approved by NDHQ and are components of the total research and development program of CRAD branch. The Defence Sciences Division is the unit responsible for the CB defence research programs at DRES, and the Program Support Office is responsible for the supervision of all activities requiring use of the range area, including field trials, and the storage and destruction of toxic materials. In the course of my Review I visited all sections and laboratories of the Defence Sciences Division, and toured the Experimental Proving Ground and associated facilities. What follows is a summary of what I found. A more detailed report of this "program audit" will be found in Appendix F.

Staffing

DRES employs 190 full-time personnel and a total staff of 220, including part-time and student employees, of whom less than half are employed on the CB defence program. The staff is professionally well-qualified, highly motivated, and very conscious of the responsibilities associated with their work with extremely hazardous substances.

Programming

I reviewed the program in detail, paying particular attention to the process by which it is developed. This process is an extension at the "working level" of that described in the preceding chapter, and I am satisfied that it provides adequate assurance that each individual component of the CB program is entirely defensive in character, and is scientifically justifiable in relation to the over-all program goals set by CRAD. The risks associated with the research and testing called for in the individual projects are carefully assessed and the arangements for conducting the program reflect the best professional judgment of the staff, supplemented, if necessary by outside advice.

Safety

Safety, including environmental concerns, occupational health and safety, and physical security is a primary consideration in all the CB work carried on at DRES. There is a safety committee, which includes membership by both management and unions, as well as appropriate representation from CFB Suffield. There is a safety manual covering every aspect of the activities of DRES, and drills are conducted periodically. In addition the CFB Suffield medical facilities are available to DRES.

Environmental Considerations

Liaison arrangements now exist with both the federal and provincial environment departments and with Labour Canada. The Canadian Environmental Protection Act, which came into force recently, introduces a new dimension to these relationships. The act not only sets out environmental goals, but also sets out terms of compliance and enforcement (see Appendix K). Consultations are now under way to ensure full compliance by DRES with the new statute.

Main Laboratory

The main laboratory building is over thirty years old and although facilities (e.g. fume hoods, controlled air pressure, decontamination rooms, etc.) have been well maintained and modernized as required to comply with professional standards, the structure is inadequate to meet fully the needs of the research program, particularly now that work is being transferred to Suffield from DREO. I understand that plans are now being made for the construction of a new laboratory building in the mid nineteen-nineties. It is apparent that the current chief is making vigorous efforts to enhance physical security in the laboratory building. These efforts are endorsed and should be completed as soon as possible. The control system governing the issue and use of potentially dangerous agents or materials in the laboratories ensures that quantities are limited to the amount needed for approved research and development activities. The safety arrangements for the preparation, handling, storage, use, disposal and transportation of such materials which are in effect, are very thorough and comply with federal and provincial regulations.

Experimental Proving Ground (EPG)

Field Operations

The EPG is that portion of the Suffield Range allocated to DRES for its field experiments. It is much smaller than the test area available during and immediately after World War II, but is still very large by the standards of similar installations elsewhere in the world, encompassing an area of about 500 sq. km. In addition, of course, the remainder of the range, now used by the army is there as a downwind buffer if it were needed.

The EPG is the "raison d'etre" for the existence of DRES in the relative isolation of southeast Alberta. I visited the field test areas and laboratories and also examined the toxic storage and toxic waste disposal sites. Control and security arrangements for the whole range area, including the EPG are under the over-all direction of CFB Suffield. They include a requirement for project authorization, radio monitoring of all activities and vehicles, and a strictly-applied pass system. DRES has local responsibility for what goes on in the EPG, but in conformity with CFB Suffield regulations and controls.

I reviewed the planning and conduct of field trials, particularly with respect to those involving the release of toxic materials. All trials must be approved by DRES management as components of authorized projects. If toxic materials are to be used a hazard assessment is required and safety parameters, particularly meteorological conditions, must be established.

Field trials involving the participation of volunteers in the presence of chemical warfare agents have not been carried out for the last twenty years. It should be noted, however, that each year the NBC Staff Course of the NBC School of the Canadian Forces (see Chapter VIII) visits Suffield, and the students, wearing protective clothing, are required as part of their training, to decontaminate equipment which has been contaminated by mustard gas. This exercise is considered to be an essential component of the training program. Since all personnel utilize well-tested operational protective equipment, there have, thus far, been no casualties, and in my view the risk of accident is minimal. From time to time the Canadian Forces also conduct exercises on the Suffield range utilizing simulants and training agents (e.g. CS).

Storage and Disposition of Toxic Materials

From the outset, the Suffield Range was utilized for storage of munitions and bulk quantities of agents, and magazines and storage areas were set aside for the purpose, including lead-lined tanks to hold more than 700 tons of mustard gas established as a war-time reserve. During the first twenty years following the war substantial efforts were made to destroy munitions and agents, however the range was still littered with exploded and unexploded munitions, and contaminated areas. At the same time the mustard gas in storage had deteriorated to a sticky, but still highly toxic mess.

In the early nineteen-seventies, perhaps triggered by plans to allow the development of gas and oil resources on the range, a clean-up was authorized and a program for destruction of the mustard reserves approved. During the next five years old metal was gathered up and placed in two large contaminated junk piles well away from everything else, and almost all the mustard was destroyed. Unfortunately, a breakdown of equipment and conflicting priorities for resources prevented completion of the operation.

This year, the Minister of National Defence became aware that there were still about 18 tons of agents and 150 tons of contaminated materials remaining to be disposed of, and gave direction that immediate action be taken to complete the clean-up.

I have reviewed the DRES plan for clean-up, which consists of two parts. Nerve agents, and to the extent practicable, mustard, will be destroyed chemically. Contaminated material, mostly consisting of rusted drums containing toxic chemical residues, cannot easily be decontaminated, and will be incinerated without prior treatment. Mustard gas may also be destroyed by incineration without previous chemical destruc-

tion, if this approach is acceptable from the environmental point of view. The plan has been developed in consultation with waste disposal experts, and once the approval of the federal and provincial environmental authorities has been obtained, the work should be able to get under way expeditiously. Even so, it is expected that it will take up to three years to complete.

Public Safety

I have taken particular note of correspondence received by the Minister of National Defence from members of the Canadian scientific community expressing concern that the possibility of downwind drift of relatively small quantities of toxic vapour from outdoor tests has been underestimated by the staff of DRES, and that people or animals as far as 50 km. from the test site could be endangered. The scientists at DRES, in the light of their knowledge and experience, do not agree with this assessment. Here we have an honest difference of opinion between scientists, which could only be resolved by an impartial assessment which took into account both facts and expertise. Rather than commissioning such a study as part of this Review, I believe that the most useful course of action would be to rely on the legislative provisions of the new Canadian Environmental Protection Act. These provisions will be applicable to all aspects of the research and development program in the future, and be the determinant as to whether and under what circumstances such tests might be carried out.

Consultations with the federal and provincial environmental authorities on the environmental impact of the continuing program at DRES will need to be instituted as soon as possible. As mentioned earlier in this chapter, consultations are already under way concerning the disposition of excess stocks of agent and contaminated materials. Pending the completion of arrangements approved by the environmental authorities, I believe that the existing safety regime at DRES is adequate and in compliance with statutory requirements.

The consultations with the environmental authorities referred to above will presumably be focussed on the substance of the program at DRES. There is also the question of the environmental adequacy of operating practices. Based on my observations, these are well-maintained, but a full environmental audit should be commissioned as soon as possible, and be repeated at regular intervals.

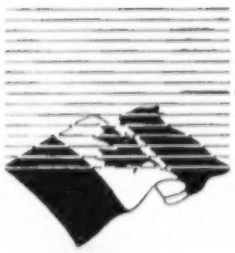
RECOMMENDATIONS

I recommend that:

- A procedure be established to ensure that the DRES Safety Manual is reviewed at prescribed regular intervals, say three years. Safety drills should also be conducted at prescribed regular intervals.
- An automatic annual review and certification procedure be instituted to confirm that stocks of all toxic agents are being kept to the minimum level necessary for the efficient conduct of the research and development program.
- The arrangements now being implemented to improve security and access controls at DRES be expedited.
- Pending the destruction of the excess agent stocks now stored on the EPG, the adequacy of existing physical security arrangements for the EPG, should be reviewed with a view to strengthening them.
- The incinerator which is to be acquired for the program be considered for use in the destruction of other dangerous industrial chemicals, including PCBs.
- EPG operation and maintenance be given "project" status, within the CRAD program with a priority equivalent to that of the main research and development activities of DRES, or alternatively, a management audit be held annually to ensure that the requirements of essential support services are met adequately.
- The scope of the safety and environmental requirements governing any future proposed outdoor testing programs at DRES be determined by the provisions of the Canadian Environmental Protection Act.
- A full environmental audit of DRES be commissioned as soon as possible, and that it be repeated at regular intervals of, say five years.

CHAPTER VI

DEFENCE RESEARCH ESTABLISHMENT OTTAWA (DREO)



As described earlier in this Review, DREO and its predecessor establishments have had a history of involvement in CB defence research and development over a period of nearly fifty years. Although DREO's original role was related entirely to chemical defence, over the years research in the areas of nuclear defence, electronics technology, the arctic, electrochemical power sources, communications and radar, has been added to the program. At the same time the chemical defence program has grown smaller.

As indicated in Chapter IV, CB defence activities carried out at DREO are now in the process of being transferred to DRES. Pending the completion of the transfer DREO's work in this field is concerned with three main areas of CB protection. First is in the chemistry of adsorption of toxic agents, which is the essential element in the development of protective equipment. Second is the development of new materials and assessment of their potential protective capabilities. Finally, DREO carries out engineering development of protective equipment, including clothing.

The work is carried out by the Chemical Protection Section (CPS) of the establishment, which comprises five groups, namely Materials Development, Materials Chemistry, Polymer Research, Engineering Development, and Chemistry. As in the case of DRES, I visited the laboratories and other facilities of DREO concerned with CB research and development, and found them to be excellent, with safety installations and equipment, such as ventilating machinery, to be of the highest quality. The work at DREO requires the use of only very limited quantities of chemical agents in a carefully controlled laboratory environment. There is no outdoor testing involving chemical agents and DREO does not have a waste disposal problem.

CONCLUSIONS

The systems and procedures relating to physical security at DREO, and the security arrangements for the storage and handling of highly toxic chemicals are thorough and of a high standard. Total stocks of such chemicals are being kept to a minimum and I believe the holding is not excessive in relation to the requirements of the research program. Procedures for storage and handling of agents are set out in a safety manual, and reviewed at regular intervals by a safety committee. I was impressed by the safety consciousness of the staff. In my view the work at DREO is being conducted in a manner which does not present a hazard to DREO employees or others at the Shirley Bay site. A detailed account of my examination of the CB defence activities carried out at DREO will be found in Appendix G.

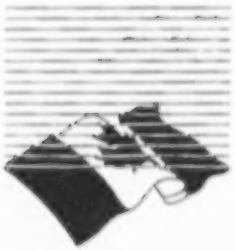
RECOMMENDATIONS

I recommend that:

- A regular annual review procedure be instituted at DREO to confirm for the record that stocks of chemical agents are being kept to the minimum necessary for the research and development program.
- As a part of the implementation of the Canadian Environmental Protection Act, an environmental audit of DREO be carried out at the first convenient opportunity, and at regular intervals (say 5 years) thereafter.

CHAPTER VII

OTHER RESEARCH PROGRAMS



DEFENCE AND CIVIL INSTITUTE OF ENVIRONMENTAL MEDICINE (DCIEM)

The small chemical and biological defence component of the program at this Institute, situated in Downsview, Ontario, is concerned primarily with protective equipment for use by aircrew. It involves the evaluation of fully integrated aircrew life support systems which incorporate CB protection, and procedures for entering and leaving aircraft and pilot briefing facilities in a chemical environment. Research is also being carried out on the use of liposomes as carriers of protective and immunizing agents for targeting to specific sites in the body susceptible to the effects of chemical agents.

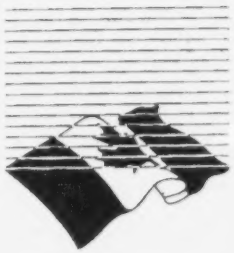
I visited DCIEM, toured the laboratories, and reviewed the program with the chief of the establishment. A more detailed outline of the work of DCIEM is attached at Appendix J. The work being done there encompasses an important element of CB protection for the Canadian Forces. No CB agents are used at DCIEM and if testing involving agents is required, that aspect of the work is carried out at DRES or DREO.

OTHER RESEARCH AND DEVELOPMENT

Research and development projects are contracted out to universities, provincial research organizations, and to industry, both by CRAD Headquarters and by individual research establishments. They are defined and managed as components of the over-all research and development program. Any aspect of these projects involving the use of CB agents is carried out at DRES or DREO.

CHAPTER VIII

MILITARY OPERATIONS AND TRAINING



GENERAL

The terms of reference of this Review enjoin me to satisfy myself that Canada's policy of maintaining only a defensive capacity in the chemical and biological field is fully respected at all times, and with particular reference to the Canadian Forces, to ensure that any training activities are professionally conducted and pose no threat to public safety or the environment

As indicated in Chapter IV of this Review, the policy governing the Canadian Forces with respect to CB matters is clearly limited to a defensive role, as is set out in Policy Directive P3/85. This defensive role is further developed in a lengthy document entitled "Concept for Nuclear, Biological and Chemical (NBC) Defence of the Canadian Forces (CF), 1985-2000." The aim of the concept is to address the measures and requirements for defence against the effects of nuclear, biological and chemical weapons, including toxins, for CF operations in the 1985-2000 timeframe. This it does in great detail under the general headings of Hazard Avoidance, Protection - individual and collective, and Decontamination.

TRAINING

The Concept Paper sets out the training requirements in the following terms:

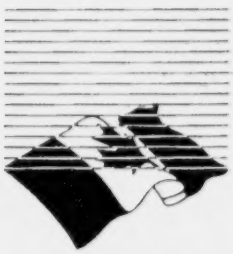
> "Training is the catalyst that enables the unit to function effectively...Initially, realistic NBC defence training will hamper individual and unit performance. Realistic training done repetitively, however, will improve individual skills and give the unit confidence in its ability to succeed even if NBC weapons are employed against it. Exercises and materiel that promote realism in NBC defence training are required as follows:
>
> a. Training systems to simulate ground and air burst NBC munitions and high-speed aerial delivery systems.
>
> b. Realistic simulants for persistent and non-persistent chemical agents that will activate detection, identification and alarm devices, inflict punitive measures against poorly-trained individuals, provide detection, capability for percutaneous entry, and provide appropriate response to decontamination procedures.
>
> c. Individual training aids that replicate operational protective clothing and equipment, self-aid and buddy-aid treatments, and decontamination and detection devices; are inexpensive; and conserve operational stocks.
>
> d. Force readiness evaluations that document a unit's ability to operate in an NBC environment.
>
> e. National and combined exercises that accurately portray the use of NBC weapons and require the engaged units to enact proper NBC defence measures."

The key establishment in the attainment of these training aims is the Canadian Forces Nuclear, Biological and Chemical School (CFNBCS), at CFB Borden, Ont. It is here that staff officers, technical personnel and instructors for the various formations and units of the CF are trained.

I visited the School and reviewed the syllabi of the courses of instruction, all of which comply with the guidelines laid down in Policy Directive P3/85 and the concepts paper described above. I also reviewed the various types of training aids and simulants used, and the established procedures for their use. These comply with safety standards prescribed by the Surgeon General of the Canadian Forces, and with CF regulations regarding the storage and handling of pyrotechnics. As is described in Chapter V of this Review, the NBC Staff Officer training course at the School visits DRES and carries out an exercise involving the decontamination of mustard-contaminated equipment. The operational requirement for such an exercise is reasonable in my view, and the strict safety precautions followed are adequate for the purpose In addition, I reviewed the training programs of the formations and units of the CF, and found that as in the case of the School, they adhere strictly to the policies and regulations established by the Canadian Forces Further information on military training in CB defence will be found in Appendix H.

CHAPTER IX

CONCLUSIONS AND RECOMMENDATIONS



INTRODUCTORY COMMENTS

Before setting out the conclusions I have formed after carrying out this Review, it is important to establish what for want of a better term I might call the personal resource- base I have drawn upon. For the last thirty-odd years of my working life, both at home and on assignments abroad, my primary concerns were with the United Nations and the attainment of its goal of international peace and security. For several years I was Canada's chief disarmament negotiator, and was deeply involved with efforts to conclude an agreement to ban chemical weapons. After retirement, I had the honour of becoming the first Chairman of the Board of Directors of the Canadian Institute for International Peace and Security, which is very much concerned with Canada's contribution to progress in these areas.

I have also had one other resource to draw on, the value of which I was not certain when I took on the assignment, but which has proven to be most useful. During World War II I served in the Army as a chemical warfare officer, and for a time was stationed at Suffield.

After more than forty-five years away from the intricacies of chemical and biological matters, I found that although much has changed, my experience is still relevant. I found also that the conviction of wartime chemical warfare officers, that the introduction into combat of chemical weapons would be morally indefensible, is shared by our soldiers and researchers today.

I have set out this bill of particulars in the hope that it will convince readers that this Review is not an apologia for the Department of National Defence. At the same time, it is important not to lose sight of the problems and difficulties faced by the department in ensuring that Canadians are assured of having the best defensive CB equipment and training that can be devised. The useful background of experience I have been able to draw on in dealing with the subject-matter of this Review has reinforced my conviction that these concerns are not in conflict with each other.

GENERAL OBSERVATIONS

Recent developments in the USSR, and the more constructive position its diplomats have been taking in Geneva and elsewhere, give grounds for modest optimism that a Convention banning chemical weapons might be negotiated in the foreseeable future. The fact remains however that the Soviet Union maintains large CB forces with a known capacity to use chemical agents in battle, and has a large CB research and development program. Additionally, chemical agents have been used in a number of areas where Canadian troops have been, or might be called upon, to carry out a peacekeeping role. In these circumstances prudence continues to require that the Canadian Forces be equipped with the best protective equipment available, and over the last half-century Canadian science and industry have met this challenge.

Inevitably, the CB defence programs of Canada and its Western Allies and friends are confused in the public mind with offensive CB warfare. On the one hand, lack of knowledge about the essentials of CB defence, and on the other, the aura of secrecy which surrounds the work, inspire public mistrust. From time to time efforts have been made to overcome this distrust, but without lasting effect. A good example is the report of Harold Winch, MP, following a visit to DRES in 1970, in which he came to conclusions very similar to those in this Review.

In my view, the mystery associated with chemical and biological defence, at least so far as the Canadian program is concerned, is largely unnecessary. The spectrum of CB agents, their characteristics, and defensive measures against them have been well-known for many years. The only requirements for secrecy are related to the development of new and improved protective capabilities in our defensive equipment and detection techniques, and in the area of identifying potential new threats and what can be done to counter them.

Some people are suspicious that this work is as much aimed at finding materials which Canada or its friends might plan to divert to offensive uses, as it is concerned with defence. To them I can only say that I found not a scintilla of evidence to support such a thesis. There is certainly nothing of this sort going on in Canada, and if any of the nations associated with us in cooperative programs were pursuing a new agent weapons program, they would not rely on the information they get from us to further such a purpose. All these considerations indicate that there is a real need to improve the general understanding of the problems associated with CB defence, and what the Department of National Defence is doing to resolve them.

Of course, some of the research work involves the use of highly toxic materials, and just as in university or industrial laboratories, extreme care must be taken to ensure that access is restricted to those whose presence is essential to the work in hand. This is also true for the outdoor testing carried out at the DRES Experimental Proving Ground. But this is not secrecy. It is simply common sense and compliance with the practice of environmental and health procedures prescribed by the appropriate federal and provincial authorities.

Although there is some contact with the outside community through university research projects and industrial development and production contracts, the CB defence research program is essentially a closed system. I believe that there would be general benefit if, at regular intervals, the program could be subjected to scrutiny and a "second opinion" by a group of respected senior scientists and engineers from the outside community.

All research and development related to materials or equipment intended for human use sooner or later requires testing to determine whether the product does what it is supposed to, and whether there are any deleterious side effects. This truism applies to CB defence as much as to cosmetics or house paint. Does a respirator irritate the skin, or do the eye-pieces fog up if it is worn for a lengthy period? How long can a soldier function efficiently when wearing protective clothing? Above all, does the equipment protect against the toxic agents likely to be encountered, and do the neutralizing and decontaminating agents really work? The only way to find out is by tests, sometimes involving human volunteers or animals, carefully designed to reduce any risk to an essential minimum.

During World War II and for some years after, large-scale tests were carried out at Suffield, involving the release of substantial quantities of chemical agents by a variety of weapons, and the controlled exposure of numbers of human volunteers. I do not propose, with the hindsight of 1988 to debate the merits of such programs, since they are precluded by current policies, which have been in effect for the past twenty years, imposing strict limitations on the size of tests and the use of volunteers.

Under current policy guidelines, tests carried out at defence research establishments involving the use of volunteers must be subjected to rigorous examination as to necessity, and are subject to approval by ethics committees which include representatives from local non-governmental medical communities. These committees are guided by internationally agreed ethical standards, such as the Nuremberg rules and the Declaration of Helsinki. In fact, no trials involving unprotected human exposure to chemical warfare agents have been conducted since the late nineteen-sixties.

Animals are used in some research, but only when deemed to be essential. The Department of National Defence subscribes to the Ethics of Animal Experimentation and follows the principles of animal care and use outlined in the "Guide to the Care and Use of Experimental Animals" published by the Canadian Council on Animal Care (CCAC).

The Experimental Proving Ground at Suffield is a unique facility whose value has been demonstrated over a period of nearly fifty years. Limited outdoor tests, made possible by the very large safety distances available, and involving the use of small quantities of chemical agents, but not biological warfare agents, are highly important to the conduct of the CB defence program. It should be recognized that irrespective of whether or not efforts to negotiate a treaty banning chemical warfare are successful, there will continue to be a need for a CB defence program. The draft treaty now being negotiated acknowledges this reality and makes provision for the conduct of protective research. Subject to the requirements of the environmental authorities, I think it is in the national interest to ensure that this facility continue to fulfill its important role in the years to come.

RECOMMENDATIONS

I. With the best will in the world familarity breeds complacency. It is therefore recommended that in the course of the annual program and budgetary process, the authorizing officer at each level be required to sign a certificate of compliance with the policies and guidelines prescribed by the department. This will help to ensure that all activities to be funded have been examined specifically from the point of view of conformity with prescribed policies and practices.

II. It is recommended that there should be established an advisory committee of senior people, representative of the scientific and industrial communities, the task of which would be to review periodically (say once each year), the CB defence research and development program and visit the various facilities. It would seem appropriate that it be associated with the Defence Science Advisory Board which I understand is being set up, and which is to report to the Chief of the Defence Staff and the Deputy Minister of National Defence. If its work is to be useful it will be important to ensure that persons of appropriate stature and qualifications are recruited to take on the commitment.

III. It is recommended that consideration be given to extending the concept of obtaining outside "second opinions" on some of the potentially controversial test programs, particularly at Suffield. I realize that it is not easy to find people with the requisite scientific expertise outside the defence community, but I think there would be merit in getting the judgment of scientists in related fields, even if they are not expert in the specifics of the subjects under discussion. If it did nothing else it would add to their understanding of the nature of the problems faced in the CB research and development program.

IV. It is recommended that a document be prepared annually which would set out the nature of the research and development work going on, the numbers of people involved, and the allocation of funds. The document would be aimed at persons not closely involved with the program. This document might form part of the supplementary information provided in Part 3 of the Estimates to Parliament, and could be made available on request to interested persons or groups. This document would help dispel the air of mystery which surrounds the work.

V. It is recommended also that a layman's pamphlet or handbook be published which would help to improve public understanding about CB defence. It would explain the nature of the problems faced by the armed forces, and also, potentially, by civil emergency preparedness organizations, and what is being done to overcome them. It would also make the work that is being done at the defence research establishments more comprehensible.

VI. I believe that the policies and procedures regarding the use of volunteers or animals followed at the defence research establishments carrying out CB defence programs are appropriate, but I recommend that they be embodied in an explicit departmental directive.

In addition to the above recommendations, there are a number of detailed proposals contained in the body of the Review. Many of these observations have already been acted upon, or are in process of being taken care of, however they are repeated below for ease of reference.

DRES

It is recommended that:

- A procedure be established to ensure that the DRES Safety Manual is reviewed at prescribed regular intervals of not more than three years. Safety drills should also be conducted at prescribed regular intervals.

- An automatic annual review and certification procedure be instituted to confirm that stocks of all toxic agents are being kept to the minimum level necessary for the efficient conduct of the research and development program.

- The arrangements now being implemented to improve security and access controls at DRES be expedited.

- Pending the destruction of the excess agent stocks now stored on the Experimental Proving Ground, the adequacy of existing physical security arrangements for the EPG be reviewed with a view to strengthening them.

- The incinerator which is to be acquired for the program be considered for use in the destruc-

tion of other dangerous industrial chemicals, including PCBs.

- EPG operation and maintenance be given "project" status within the CRAD program, with a priority equivalent to that of the main research and development activities of DRES. Alternatively, a management audit be held annually to ensure that the requirements of essential support services are met adequately.

- The scope of the safety and environmental requirements governing outdoor testing at DRES be determined by the provisions of the Canadian Environmental Protection Act.

- A full environmental audit of DRES be commissioned as soon as possible and that it be repeated at regular intervals of, say five years.

DREO

I recommend that:

- A regular annual review procedure be instituted at DREO to confirm for the record that stocks of chemical agents are kept to the minimum necessary for the research and development program.

- As a part of the implementation of the Canadian Environmental Protection Act, an environmental audit of DREO be carried out at the first convenient opportunity, and at regular intervals (say five years) thereafter.

GENERAL CONCLUSIONS

In a series of activities as complex and technically challenging as the chemical and biological defence program of the Department of National Defence, it will be necessary always to be vigilant to avoid complacency and the possibility of unwarranted departures from the policy guidelines of the government. On the whole I believe that the Department of National Defence has installed and is maintaining the systems to ensure that these guidelines are followed. As a result of this Review I have proposed some additional measures to improve on the existing high standards maintained by the dedicated personnel charged with the important task of keeping our CB defences at the highest possible level. I have no hesitation in concluding with the following general observations:

- It is my opinion that the stated intention of the Canadian Government to ensure that members of the Canadian Forces have adequate training and equipment to protect themselves against chemical and biological warfare is the only prudent option open, and is in itself entirely consistent with the international obligations undertaken by the government.

- The policy guidelines set out by the government and reflected in the policy statement made at the United Nations in 1971 (see Chapter III), and those contained in Appendices B, C, and E to this Review are being strictly adhered to by the Department of National Defence.

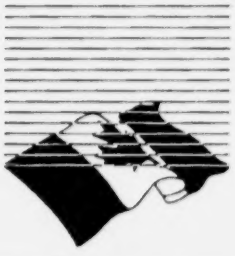
- The Canadian Forces possess no offensive chemical or biological weapons. The programs of training, and research and development are strictly defensive in character. Incidentally these programs have provided the CF with what are widely acknowledged to be among the best defensive equipment and CB defence military operational skills in the world.

- There is no hidden agenda for the development of new agents either for possible use by Canadian Forces, or on behalf of our Allies and friends. The international programs are all aimed at utilizing scarce resources cooperatively by the participating nations, to enhance the defensive capacity of the forces involved.

- The Department of National Defence is using its best endeavours to comply as a good corporate citizen, with relevant federal and provincial statutes, regulations and guidelines in respect of the environment, public health and occupational health and safety.

APPENDIX A

TERMS OF REFERENCE REVIEW OF RESEARCH, DEVELOPMENT AND TRAINING ON CHEMICAL AND BIOLOGICAL DEFENCE WITHIN THE DEPARTMENT OF NATIONAL DEFENCE AND THE CANADIAN FORCES



BACKGROUND:

1. The policy of the Government of Canada is to press for a global, comprehensive and verifiable treaty to ban all chemical biological weapons. While the threat from such weapons remains, however, Canada has an obligation to ensure that members of the Canadian Forces have adequate training and equipment to protect themselves against exposure to chemical and biological agents.

2. On the other hand, the Canadian public has a right to be assured that Canada's policy of maintaining only a defensive capability in this field is fully respected at all times, and that any research, development and training activities undertaken by this country are professionally conducted and pose no threat to public safety or the environment.

AIM:

3. The aim of this review is to ensure that all research, development and training activities in chemical and biological defence undertaken by the Department of National Defence are, in fact, defensive in nature and are conducted in a professional manner with no threat to public safety or the environment.

EXECUTION:

4. The review will include an environmental and safety audit and will take into consideration but not limit itself to:

a. The biological and chemical defence research and development activities at the Defence Research Establishment Suffield.

b. The chemical research and development activities at the Defence Research Establishment Ottawa.

c. The quantity of chemical agents at the Defence Research Establishments.

d. Methods of destruction of excess quantities of chemical agents at the Defence Research Establishment Suffield.

e. Safe storage of quantities of chemical agents necessary for on-going research and development.

f. The development and implementation of safe training methods and procedures throughout the Canadian Forces.

5. The review will result in a report, to be submitted to the Minister of National Defence by 31 December 1988, and to be prepared for public release. This report should guide the development and implementation of the Department's policies relating to this area, including:

a. a clear statement of principles confining all research, development and training to defensive activities;

b. assurance that all research, development and training are necessary and are professionally conducted;

c. assurance that no quantities of potentially dangerous agents will be maintained beyond

those needed for legitimate research, development and training;

d. recommendations for the safe preparation, handling, transportation, storage and use of all agents and for the safe disposal of all waste material;

e. appropriate consultation with relevant authorities at all levels of government and appropriate public information policies; and

f. a suitable arms-length mechanism to review policies and procedures on an ongoing basis to ensure that any work conducted remains defensive in nature and that public health, environmental, and occupational safeguards are adequate, fully respected, and consistent with the new Canadian Environmental Protection Act.

COORDINATION:

6. *Assignment of Responsibilities:*

a. *OPI*

ADM(Mat) is appointed OPI for the review.

b. *Review Director*

To be appointed by MND.

c. *Conduct of the Review*

All elements of DND and the CF are to assist in the conduct of the review as required by the review director.

7. *Support*

a. Support Staff

CRAD is to arrange for the provision of support staff as required.

b. *Technical Support*

To be available from whatever sources the review director requires.

c. *Accommodation*

To be arranged by DG Exec. Sec as required.

d. *Administration*

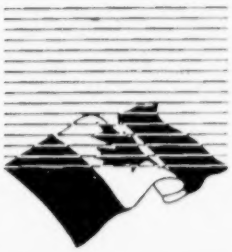
To be arranged by CRAD as required.

e. *Access*

The individual conducting the review is to be given full access to all relevant information and personnel.

APPENDIX B

PROTOCOL FOR THE PROHIBITION OF THE USE IN WAR OF ASPHYXIATING, POISONOUS OR OTHER GASES, AND OF BACTERIOLOGICAL METHODS OF WARFARE



SIGNED AT GENEVA JUNE 17, 1925 ENTERED INTO FORCE FEBRUARY 8, 1928

The Undersigned Plenipotentiaries, in the name of their respective Governments:

Whereas the use in war of asphyxiating, poisonous or other gases, and of all analogous liquids, materials or devices, has been justly condemned by the general opinion of the civilised world; and

Whereas the prohibition of such use has been declared in Treaties to which the majority of Powers of the World are Parties; and

To the end that this prohibition shall be universally accepted as part of International Law, binding alike the conscience and the practice of nations;

Declare:

That the High Contracting Parties, so far as they are not already Parties to Treaties prohibiting such use, accept this prohibition, agree to extend this prohibition to the use of bacteriological methods of warfare and agree to be bound as between themselves according to the terms of this declaration.

The High Contracting Parties will exert every effort to induce other States to accede to the present Protocol. Such accession will be notified to the Government of the French Republic, and by the latter to all signatory and acceding Powers, and will take effect on the date of the notification by the Government of the French Republic.

The present Protocol, of which the French and English texts are both authentic, shall be ratified as soon as possible, it shall bear today's date.

The ratifications of the present Protocol shall be addressed to the Government of the French Republic, which will at once notify the deposit of such ratification to each of the signatory and acceding Powers.

The instruments of ratification of and accession to the present Protocol will remain deposited in the archives of the Government of the French Republic.

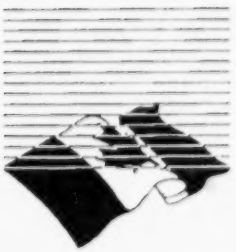
The present Protocol will come into force for each signatory Power as from the date of deposit of its ratification, and, from that moment, each Power will be bound as regards other powers which have already deposited their ratifications.

IN WITNESS WHEREOF the Plenipotentiaries have signed the present Protocol.

DONE at Geneva in a single copy, this seventeenth day of June, One Thousand Nine Hundred and Twenty-Five.

APPENDIX C

CONVENTION ON THE PROHIBITION OF THE DEVELOPMENT, PRODUCTION AND STOCKPILING OF BACTERIOLOGICAL (BIOLOGICAL) AND TOXIN WEAPONS AND ON THEIR DESTRUCTION



SIGNED AT WASHINGTON, LONDON, MOSCOW APRIL 10, 1972

The States Parties to this Convention, Determined to act with a view to achieving effective progress towards general and complete disarmament, including the prohibition and elimination of all types of weapons of mass destruction, and convinced that the prohibition of the development, production and stockpiling of chemical and bacteriological(biological) weapons and their elimination, through effective measures, will facilitate the achievement of general and complete disarmament under strict and effective international control,

Recognizing the important significance of the Protocol for the Prohibition of Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare, signed at Geneva on June 17, 1925, and conscious also of the contribution which the said Protocol has already made, and continues to make, to mitigating the horrors of war,

Reaffirming their adherence to the principles and objectives of that Protocol and calling upon all States to comply strictly with them,

Recalling that the General Assembly of the United Nations has repeatedly condemned all actions contrary to the principles and objectives of the Geneva Protocol of June 17, 1925,

Desiring to contribute to the strengthening of confidence between peoples and the general improvement of the international atmosphere,

Desiring also to contribute to the realization of the purposes and principles of the Charter of the United Nations,

Convinced of the importance and urgency of eliminating from the arsenals of States, through effective measures, such dangerous weapons of mass destruction as those using chemical or bacteriological (biological) agents,

Recognizing that an agreement on the prohibition of bacteriological (biological) and toxin weapons represents a first possible step towards the achievement of agreement on effective measures also for the prohibition of the development, production and stockpiling of chemical weapons, and determined to continue negotiations to that end,

Determined, for the sake of all mankind, to exclude completely the possibility of bacteriological (biological) agents and toxins being used as weapons,

Convinced that such use would be repugnant to the conscience of mankind and that no effort should be spared to minimize this risk,

Have agreed as follows:

ARTICLE I

Each State Party to this Convention undertakes never in any circumstances to develop,

produce, stockpile or otherwise acquire or retain:

(1) Microbial or other biological agents, or toxins whatever their origin or method of production, of types and in quantities that have no justification for prophylactic, protective or other peaceful purposes;

(2) Weapons, equipment or means of delivery designed to use such agents or toxins for hostile purposes or in armed conflict.

ARTICLE II

Each State Party to this Convention undertakes to destroy, or divert to peaceful purposes, as soon as possible but not later than nine months after the entry into force of the Convention, all agents, toxins, weapons, equipment and means of delivery specified in article I of the Convention, which are in its possession or under its jurisdiction or control. In implementing the provisions of this article all necessary safety precautions shall be observed to protect populations and the environment.

ARTICLE III

Each State Party to this Convention undertakes not to transfer to any recipient whatsoever, directly or indirectly, and not in any way to assist, encourage, or induce any State, group of States or international organizations to manufacture or otherwise acquire any of the agents, toxins, weapons, equipment or means of delivery specified in article I of the Convention.

ARTICLE IV

Each State Party to this Convention shall, in accordance with its constitutional processes, take any necessary measures to prohibit and prevent the development, production, stockpiling, acquisition or retention of the agents, toxins, weapons, equipment and means of delivery specified in article I of the Convention, within the territory of such State, under its jurisdiction or under its control anywhere.

ARTICLE V

The States Parties to this Convention undertake to consult one another and to cooperate in solving any problems which may arise in relation to the objective of, or in the application of the provisions of, the Convention. Consultation and co-operation pursuant to this article may also be undertaken through appropriate international procedures within the framework of the United Nations and in accordance with its Charter.

ARTICLE VI

(1) Any State Party to this Convention which finds that any other State Party is acting in breach of obligations deriving from the provisions of the Convention may lodge a complaint with the Security Council of the United Nations. Such a complaint should include all possible evidence confirming its validity, as well as a request for its consideration by the Security Council.

(2) Each State Party to this Convention undertakes to cooperate in carrying out any investigation which the Security Council may initiate, in accordance with the provisions of the Charter of the United Nations, on the basis of the complaint received by the Council. The Security Council shall inform the States Parties to the Convention of the results of the investigation.

ARTICLE VII

Each State Party to this Convention undertakes to provide or support assistance, in accordance with the United Nations Charter, to any Party to the Convention which so requests, if the Security Council decides that such Party has been exposed to danger as a result of violation of the Convention.

ARTICLE VIII

Nothing in this Convention shall be interpreted as in any way limiting or detracting from the obligations assumed by any State under the Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare, signed at Geneva on June 17, 1925.

ARTICLE IX

Each State Party to this Convention affirms the recognized objective of effective prohibition of chemical weapons and, to this end, undertakes to continue negotiations in good faith with a view to reaching early agreement on effective measures for the prohibition of their development, production and stockpiling and for their destruction, and on appropriate measures concerning equipment and means of delivery specifically designed for the production or use of chemical agents for weapons purposes.

ARTICLE X

(1) The States Parties to this Convention undertake to facilitate, and have the right to participate in, the fullest possible exchange of equipment, materials and scientific and technological information for the use of bacteriological (biological) agents and toxins for peaceful purposes. Parties to the Convention in a position to do so shall also cooperate in contributing individually or together with other States or international organizations to the further development and application of scientific discoveries in the

field of bacteriology (biology) for prevention of disease, or for other peaceful purposes.

(2) This Convention shall be implemented in a manner designed to avoid hampering the economic or technological development of States Parties to the Convention or international cooperation in the field of peaceful bacteriological (biological) activities, including the international exchange of bacteriological (biological) agents and toxins and equipment for the processing, use or production of bacteriological (biological) agents and toxins for peaceful purposes in accordance with the provisions of the Convention.

ARTICLE XI

Any State Party may propose amendments to this Convention. Amendments shall enter into force for each State Party accepting the amendments upon their acceptance by a majority of the States Parties to the Convention and thereafter for each remaining State Party on the date of acceptance by it.

ARTICLE XII

Five years after the entry into force of this Convention, or earlier if it is requested by a majority of Parties to the Convention by submitting a proposal to this effect to the Depositary Governments, a conference of States Parties to the Convention shall be held at Geneva, Switzerland, to review the operation of the Convention, with a view to assuring that the purposes of the preamble and the provisions of the Convention, including the provisions concerning negotiations on chemical weapons, are being realized. Such review shall take into account any new scientific and technological developments relevant to the Convention.

ARTICLE XIII

(1) This Convention shall be of unlimited duration.

(2) Each State Party to this Convention shall in exercising its national sovereignty have the right to withdraw from the Convention if it decides that extraordinary events, related to the subject matter of the Convention, have jeopardized the supreme interests of its country. It shall give notice of such withdrawal to all other States Parties to the Convention and to the United Nations Security Council three months in advance. Such notice shall include a statement of the extraordinary events it regards as having jeopardized its supreme interests.

ARTICLE XIV

(1) This Convention shall be open to all States for signature. Any State which does not sign the Convention before its entry into force in accordance with paragraph (3) of the Article may accede to it at any time.

(2) This Convention shall be subject to ratification by signatory States. Instruments of ratification and instruments of accession shall be deposited with the Governments of the United States of America, the United Kingdom of Great Britain and Northern Ireland and the Union of Soviet Socialist Republics, which are hereby designated the Depositary Governments.

(3) This Convention shall enter into force after the deposit of instruments of ratification by twenty-two Governments, including the Governments designated as Despositaries of the Convention.

(4) For States whose instruments of ratification or accession are deposited subsequent to the entry into force of this Convention, it shall enter into force on the date of the deposit of their instruments of ratification or accession.

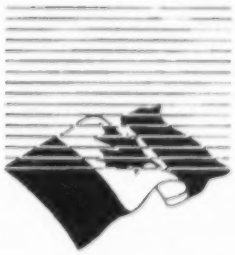
(5) The Depositary Governments shall promptly inform all signatory and acceding States of the date of each signature, the date of deposit of each instrument of ratification or of accession and the date of the entry into force of this Convention, and of the receipt of other notices.

(6) This Convention shall be registered by the Depositary Governments pursuant to Article 102 of the Charter of the United Nations.

ARTICLE XV

This Convention, the English, Russian, French, Spanish and Chinese texts of which are equally authentic, shall be deposited in the archives of the Depositary Governments. Duly certified copies of the Convention shall be transmitted by the Depositary Governments to the Governments of the signatory and acceding States.

INTERNATIONAL AGENCIES IN WHICH CANADA PARTICIPATES IN CHEMICAL AND BIOLOGICAL DEFENCE MATTERS



GENERAL

1. There are a large number of agencies and groups in the chemical and biological defence area in which Canada has been or continues to be a member. Often these agencies also deal with nuclear defence as the field of CB defence is often coupled with nuclear defence both in Canada and in international fora.

2. The list below includes only those agencies which are primarily concerned with CB, or NBC defence. Other international agencies may occasionally address a specific aspect of CB defence during the course of their primary function. To simplify the list below, these other agencies are not included as their involvement cannot be specified.

NATO CB DEFENCE AGENCIES

3. *Agencies under the Aegis of the NATO Army Armaments Group.* The NATO Army Armaments Group comprises several panels and subgroups which are tasked with the promotion of standardization and interoperability in the NATO Alliance. One of its standing panels, Panel VII, is devoted to NBC defence. Panel VII includes the following subpanels:

a. *Air Subpanel on NBC Defence.* This subgroup addresses the problems of standardization and interoperability related to Air Force operations.

b. *Naval Subpanel on NBC Defence.* This is the naval counterpart of the Air Subpanel. Its responsibilities are similar.

c. *Group of Experts on the Sampling and Identification of Chemical Agents.* This group develops and standardizes the methods for the identification of chemical agents.

4. *Agencies Under the Aegis of the Defence Research Group.* The Defence Research Group is the umbrella agency which coordinates all NATO related R&D activities. Subgroups which are involved in CB defence include:

a. *Panel 1 on Long Term Scientific Studies.* This panel does long term studies on a wide variety of subjects. In the past it has addressed CB defence issues.

b. *Panel 8 on the Defence Applications of Human and Biomedical Sciences.* This panel addresses the R&D aspects of human performance and casualty treatment. One of its subgroups, which are known as Research Study Groups (RSGs), is involved in some aspects of NBC defence. It is RSG 3 on the Prophylaxis and Therapy Against Chemical Agents.

5. *Agencies Under the NATO Military Agency For Standardization.* The NATO Military Agency for Standardization (MAS) is the general agency which prepares and staffs standardization agreements. Its subordinate agencies involved in CB

defence include:

a. MAS Army NBC Operational Procedures Working Party which addresses operational standardization; and

b. MAS Army Biological and Chemical Medical Working Party which is concerned with the medical aspects of CB defence.

QUADRIPARTITE AGENCIES

6. There are a number of agencies which involve the "ABCA nations", which despite the generic title includes the United States, the United Kingdom, Australia, New Zealand and Canada. These groups are an outgrowth of the arrangements made to cooperate during the Second World War and they are divided into Navy, Army, Air Force and R&D groups.

7. The only naval group involved in CB defence is Information Exchange Project (IEP) on NBC defence and damage control. This IEP coordinates information exchange and promotes standardization among the navies involved in the field of NBC defence and ship damage control.

8. In the ABCA Armies area there are a number of agencies all formed under the aegis of the Basic Standardization Agreement which was last updated in 1964. The army CB defence agency is the Quadripartite Working Group on NBC Defence (QWG/NBCD) which exchanges information and promotes standardization in the field of army NBC defence.

9. The air forces have two working parties, WP 61 on the Aerospace Medical and Life Support Systems, which addresses the medical aspects of NBC defence, and WP 84 which addresses operational issues. Both these WPs do similar work to that done by the naval and army agencies, but on behalf of the air forces.

10. In the research and development area cooperation is realized through The Technical Cooperation Program (TTCP) which involves all five nations, although New Zealand does not participate in all subagencies. This program was originally named the Tripartite Technical Cooperation Program (TTCP) and took its present name in 1965 when Australia became a member. TTCP comprises several subgroups, and chemical defence is the responsibility of Subgroup E, which includes the following subagencies:

a. Technical Panel 1 on the treatment of chemical agent poisoning;

b. Techical Panel 4 on biological defence technology;

c. Technical Panel 5 on the detection/monitoring and identification of chemical agents;

d. Techical Panel 7 on NBC protective equipment;

e. Technical Panel 8 on survivability and sustainability;

f. Action Group 24 on modeling and analysis of overall chemical defence procedures;

g. Action Group 32 on field therapy; and

h. Action Group 33 on aerosol technology.

OTHER ARRANGEMENTS

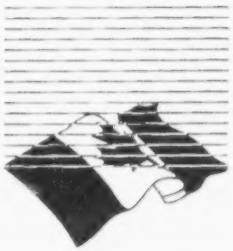
11. In addition to the above,Canada has separate bilateral agreements for research, development and production of military equipment with many nations. These are not tailored for NBC equipment but can be used to promote cooperation in the NBC defence field. In addition to the NATO and ABCA nations, Sweden and Switzerland have bilateral agreements of this type with Canada.

12. There is also a Memorandum of Understanding between Canada, the US and the UK to share defence research and development data in the chemical and biological defence area. The details of this agreement are classified. However, the agreement, and the work that is done under its aegis have been reviewed in detail, and have been found to be entirely consistent with Canadian policy. (See also reference in Chapter IV of the Review.)

13. Collaboration in chemical defence work is essential because budgets are limited everywhere and no one country can do everything. Notwithstanding, national policies with regard to what is carried out in Canada are paramount. It is entirely Canada's decision what will or will not be done in this country and what information will be released.

APPENDIX E

NDHQ POLICY DIRECTIVE P3/85 CF POLICY - NUCLEAR, BIOLOGICAL AND CHEMICAL (NBC) DEFENCE



Reference:

NDHQ Policy Directive P13 circulated under 3472-0 (DOTC)/1243-234, 13 January 1975

BACKGROUND

1. Recent international developments have suggested that the CF should review its policy on NBC defence. The previous statement of policy is outlined in the reference.

2. International developments continue to highlight the NBC threat to Canada, to CF elements deployed outside Canada or earmarked for employment in accordance with various alliance commitments. Although some apparent progress has been made toward arms control in the NBC area, intelligence sources indicate that a NBC threat will continue to be a major factor in international relations. Defensive preparations and training will continue to be necessary for the foreseeable future.

3. In developing an NBC defensive policy, DND has undertaken a variety of investigations, studies and tactical exercises associated with the development of defensive measures against the NBC threat. In addition, activity has continued in peacetime NBC defence-related areas such as nuclear safety and biological and chemical safety systems. This directive will be recognized as the governing document for all discussion at the military level and as the base document for the development of all operational and training instructions in the CF on NBC defence.

DEFINITIONS

4. For the purpose of this directive, the relevant terms are defined as follows:

a. The terms nuclear, biological and chemical warfare in this paper incorporate all aspects of such warfare, including the use of NBC weapons and those measures required to give protection against the effects of such weapons. Also included are the ancillary subjects of Nuclear Accident Response, Nuclear Safety, Radiological Safety, and Biological/Chemical Safety.

b. NBC defence is defined as only those protective measures required for the protection of CF personnel from NBC attack. It does not connote the offensive use of NBC weapons in the defensive role.

c. The terms protection and protective measures are considered to include the procedures, equipment and training for

(1) detecting, warning, and reporting,
(2) individual protection (including prophylaxis),
(3) collective protection,
(4) self-aid,
(5) first-aid,
(6) therapy, and
(7) decontamination.

d. Chemical operations are defined as the employment of chemical agents, including chemical toxins and other toxic substances,

to produce casualties in man or animals, damage to plants or material, to make hazardous the occupation of certain areas, or defence against such employment.

e. Biological operations are defined as the employment of biological agents, including biological toxins and other toxic biological substances, to produce casualties in man or animals and damage to plants or material; or defence against such employment.

f. A nuclear accident is defined as an unintended event involving loss or destruction of, or serious damage to a nuclear weapon or component or a nuclear facility resulting in

(1) a nuclear detonation of a weapon,
(2) a non-nuclear detonation of a nuclear weapon,
(3) loss or destruction of Department of Energy (USA), other Allied national or AECL-produced nuclear components, or other weapons grade fissile material,
(4) loss or destruction of components or materials of nuclear propulsion or power reactors, or nuclear weapons,
(5) radioactive contamination, or
(6) public radiological hazard.

g. A nuclear incident is defined as an unplanned event involving a nuclear weapon or component or a nuclear facility which does not result in the loss or destruction of, or serious damage to a nuclear weapon or component or nuclear facility.

AIM

5. The aim of this directive is to outline policy and to provide implementation guidance for NBC defence in the CF.

POLICY STATEMENT

6. The following statements constitute the framework of Canadian NBC defence policy.

7. *Nuclear Defence Policy*. Nuclear weapons are neither possessed by Canada nor are they, in any foreseeable circumstances, to be acquired for delivery by the CF. Canada participates, however, in defensive alliance arrangements with other nations in which nuclear weapons play an important role in the strategy of deterrence. Should deterrence fail, enemy and/or allied nations might employ nuclear weapons and the CF might therefore be required to operate in a nuclear warfare environment. In view of this possibility, the CF will be prepared to take protective measures in such an environment.

8. *Chemical and Biological Defence Policy*. Canada has ratified both the Geneva Protocol of 1925 for the Prohibition of the Use in War of Asphyxiating, Poisonous or other Gases, and Bacteriological Methods of Warfare, and the 1972 Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their Destruction. In accordance with the provisions of these instruments Canada's policy respecting biological and chemical weapons is stated below:

a. Biological Weapons.

Canada never has had and does not now possess any biological weapons (or toxin based weapons), and will not develop, produce, acquire, stockpile or use such weapons.

b. Chemical Weapons.

Canada does not possess any chemical weapons other than the devices of the type used for crowd and riot control purposes in many countries. Canada has renounced the use of chemical weapons in war, and the right to develop, produce, acquire, or stockpile such weapons for use in warfare, unless these weapons should be used against the military forces or the civil population of Canada or its allies. The latter condition is in accordance with the reservations Canada entered at the time of our ratification of the Geneva Protocol of 1925. Canada would consider formally withdrawing its reservations if effective and verifiable agreements to destroy all stockpiles and prevent the development, production and acquisition of chemical weapons can be concluded.

9. *NBC Defence Measures*. It is recognized that, under present world conditions, the CF may be committed to participate in a war where nuclear, biological or chemical weapons are used. The CF will be prepared to take the appropriate protective measures to defend elements of the CF. As a result, the CF will continue to study and to develop the knowledge necessary to ensure that the defensive measures are adequate.

10. *Nuclear Accident Response*. Although the CF possesses no nuclear weapons, elements of the CF must be prepared to respond to any nuclear accident which occurs in Canadian territory or in the surrounding territorial waters. The CF policy on Nuclear Accident Response is as follows:

a. The CF shall develop and maintain plans and procedures and a capability for prompt and effective response to any military nuclear accident in Canada or on Canadian military bases. Special arrangements may be made for nuclear accidents which occur in the 200-mile Canadian pollution control zone.

b. Command of CF personnel assigned to, and control of those activities resulting from

a military nuclear accident will be exercised by NDHQ through Region Commanders. The NDHQ OPI is the DCDS.

11. *Nuclear Safety.* Although the CF no longer has any nuclear weapons, special safety arrangements may be necessary to facilitate the operations of Allied national forces. Within the CF, the responsibility for developing and supervising the implementation of such procedures is assigned to the DCDS.

12. *Implementation.* Protective measures against NBC attacks will be implemented by all ships, bases, stations, formations and units of the CF. The degree of protection will depend on the threat presented and will be as directed by the DCDS.

DISPOSITION

13. The DCDS will, in consultation with the appropriate NDHQ Groups and Government Agencies, issue the necessary instructions to implement this directive. These instructions will cover the following general matters:

a. equipment for NBC defence;
b. provision of protective equipment to per sonnel;
c. training instructions for NBC defence;
d. instructions pertaining to research and development;
e. intelligence;
f. medical aspects of NBC defence;
g. NBC weapons or component disposal;
h. detection, warning, and status reporting; and
j. security classification guides.

COORDINATION/ RESPONSIBILITIES

14. *OPI. DCDS.*

15. *Coordination.* Appropriate NDHQ groups and staffs are authorized to liaise with Canadian authorities and other Government agencies having responsibilities in this area to ensure, where practical and economical, a common policy and common materiel for all Government Agencies. DCDS and ADM(Pol) are authorized to carry out necessary discussions with Allies in those matters pertaining to NBC defence which are their particular responsibility.

16. This directive supersedes NDHQ Policy Directive P13 issued 13 January 1975.

ORGANIZATION, DEFENCE RESEARCH ESTABLISHMENT SUFFIELD

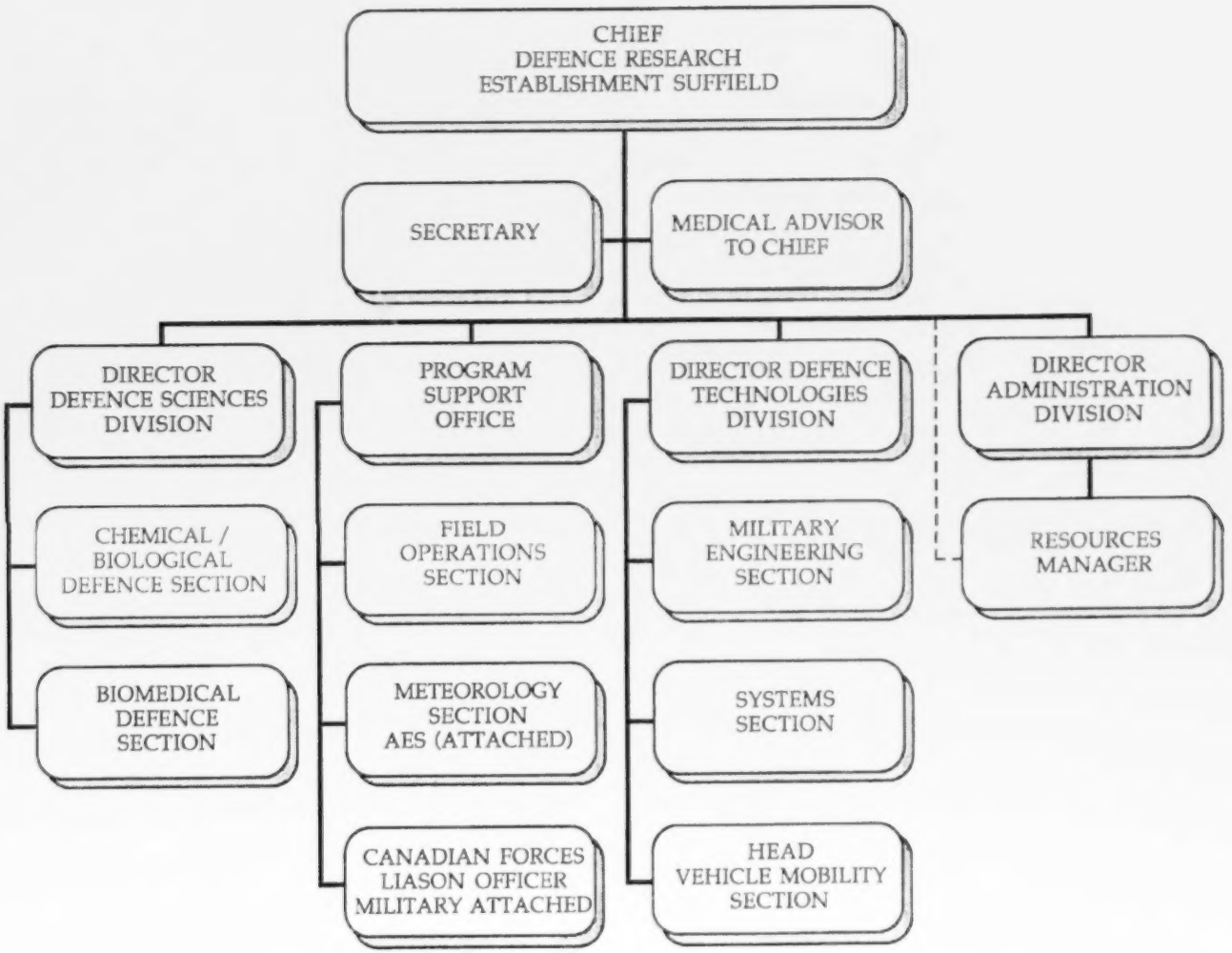
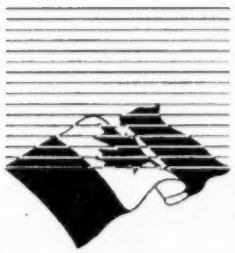


FIGURE III

DEFENCE RESEARCH ESTABLISHMENT SUFFIELD (DRES)

BACKGROUND

1. Defence Research Establishment Suffield is located in southeastern Alberta in the Suffield Military Reserve. This area has been used as a chemical and biological experimental area since 1941, when a joint British-Canadian experimental station was established. Currently the reserve is also used by:



a. British Army Training Unit Suffied (BATUS).

The British Army Training Unit is the largest unit in the area and makes use of the majority of the range area. About seven British Army battlegroups conduct three-week long exercises at CFB Suffield each year. In addition, there is a small permanent training cadre which remains at CFB Suffield all year.

b. Alberta Energy Corporation.

The Alberta Energy Corporation operates over 3500 oil and gas wells in the Suffield Military Reserve. This activity has been going on since 1976, and special arrangements are made to allow the protection and servicing of the wells in the area.

c. CFB Suffield Field Firing Area.

Based on the arrangements made for BATUS, there is a project to provide the CF with a major training area for use by Mobile Command. This area uses the same facilities used by BATUS, but also includes some special facilities for major exercises.

d. Prairie Farm Rehabilitation Agency.

This agency seasonally uses specific parts of the range area for grazing and pasturage lands on behalf of ranchers in the vicinity of the Base. Up to 5000 head of cattle graze on the range each year.

STRUCTURE AND ROLE OF DRES

2. DRES employs about 190 people on a full time basis and usually has a number of part-time and student employees so the typical strength is about 220. Less than 50 per cent are employed in the CB defence program. DRES is a lodger unit on CFB Suffield, which is under the command of Force Mobile Command (FMC) HQ in St Hubert, P.Q. DRES is subordinate to the Chief of Research and Development (CRAD) in National Defence Headquarters (NDHQ), and its program is reviewed annually, in conjunction with the other parts of the departmental R&D program, by the Program Control Board (PCB).

3. DRES is divided into four major operating divisions as shown in Figure 3. The Administrative Division provides general administrative and clerical support to the other divisions. The two major scientific divisions are the Defence Tech-

nologies Division and the Defence Sciences Division. The Defence Technologies Division is not concerned with the CB defence program and makes use of the large range area to conduct a variety of tests and trials related to military equipment. The Defence Sciences Division is responsible for the CB defence program. These two scientific divisions are assisted by the Program Support Office which provides support for all field trials and coordinates the use of field trial resources. In addition, there is a small headquarters element to support the chief of DRES and to facilitate communication with CRAD Headquarters in Ottawa. This element includes a medical advisor.

4. The Defence Technologies Division involves about half of the scientific effort at DRES and is currently involved in research and development on mine warfare, military demolitions, shock and blast testing, aerial targets, remotely piloted vehicles and vehicle mobility testing. The work of this division consumes more than half of the resources allocated to DRES.

5. The Defence Sciences Division is the division which does all of the work in the CB defence area. Its work is divided into four major functional areas as outlined below:

a. Threat/Hazard Assessment.

In this area, scientists develop computer models of the threat and hazard that CF personnel and equipment will face in any war involving the use of CB weapons. These models are validated in field trials conducted (in most cases) with chemicals that simulate agents. A significant effort is devoted to identifying appropriate simulants and to improving the methodology for field trials.

b. Detection.

Scientists in this area conduct tests and trials and carry out research to develop detectors and detection technology for use by the CF. The aim is to provide the CF with the ability to detect all CB agents. Current work includes the examination of early detection by remote sensors, the development of new point detectors, various studies of methods to confirm the identification of chemical agents and the development of a new all agent detector.

c. Hazard Management.

(Decontamination). Scientists in this area develop equipment and procedures for decontamination of personnel and equipment. The aim is to develop broad-spectrum decontaminating systems that destroy all agents rapidly without damage to personnel or equipment. Current projects include the development of a reactive skin decontamination system which will destroy agent on the skin rapidly and not damage either the user or personal equipment.

d. Prophylaxis and Therapy.

Scientists in this area conduct a biomedical assessment of the prevention and treatment of CB casualties, develop antidotes and treatment regimes and look at the potential of biotechnology for use in CB defensive applications. A new oxime, HI-6, was developed which is designed to counter the effects of nerve gas poisoning and which is now ready for human testing by a commercial laboratory. In addition, research projects are carried out on antibodies, immune systems and a variety of promising treatment approaches.

SAFETY AND SECURITY

6. A review of the physical security plans and programs affecting DRES has been completed. The review included security and safety of agent storage in the main laboratory building, general security of the Suffield range, and the security of agents stored on the range area. Separate recommendations have been made concerning possible improvements to current arrangements.

DISPOSAL OF EXCESS STOCKS OF AGENTS AND CONTAMINATED WASTE

7. DRES recognizes that the stocks of agents now held are in excess of the amount that is necessary to support the scientific and training program. The majority of the agent held is the remains of previous projects or experiments which are not now part of the program. Since 1974 there has been a continuing program to dispose of old stocks, but this has not proceeded as rapidly as desirable, in part because new expended projectiles are continually found in the range area and also because the destruction of some types of agent is a difficult and a manpower intensive task.

8. In addition to the stocks of agent, there is a large amount of metal and glass scrap which is contaminated with agent or agent decay products and decontaminants, to a degree that it cannot be disposed of in conventional ways. Current estimates put a quantity of about 150 tons of metal and glass in this category. The amount is slowly increasing as more is found and the laboratory work at DRES creates a small amount of waste each year. It should be understood that this is

totally independent of the routine garbage and waste produced by CFB Suffield.

9. At the initiative of the Minister of National Defence, action is now being taken to remedy this situation. A plan for destruction of the toxic chemicals, treatment by incineration of contaminated metal, and disposal of junk, has been prepared, and subject to the approval of the federal and provincial environmental authorities, is to be put into effect as quickly as possible.

OUTDOOR TESTING

10. Since its establishment during the Second World War, DRES or its predecessors, has conducted outdoor testing with chemical agents. In recent years, tests have been limited to small quantities of agent under tight controls, but during and for some years after the Second World War, many tests involving large quantities of chemical agents were carried out. In all the tests, there has never been a case where hazardous levels of agent are known to have escaped the confines of the range area.

11. Safety procedures for employment of chemical agents in tests include the use of a full time weather station in the main base area and local low level weather information observed at the test site itself. If either of these two stations detect or forecast any weather disturbances, the test is cancelled or terminated. The test site also has a sampling system to monitor agent concentrations immediately adjacent to, and down-wind of the agent source. Tests are planned to limit agent concentrations at the edge of the test area to the level which causes no known human effects. In addition, an area twice the size of the predicted area to be affected (test area) is cleared of all personnel. The agent is disseminated by remote control. Tests are only done when the wind direction is such that any possible residual agent is carried over approximately 45 km. of the Military Reservation, and away from populated areas.

12. The rationale for open-air testing was also examined in detail. The majority of tests are carried out with simulants but on occasion chemical agents are used to test a special feature or to relate the simulant data to the effect of a real agent. The need for effective means to test equipment and detection and decontamination procedures for chemical defence and to train CF personnel in the necessary skills is obvious, and it is the view of the Department of National Defence that the limited and carefully controlled use of chemical agents is essential for this purpose. Such tests must also meet the environmental regulations in effect for the area used.

13. No open air testing of biological warfare agents has been done since the mid nineteen-fifties. Since that time simulants have been used exclusively.

HUMAN EXPOSURES

14. During World War II and for several years thereafter, large numbers of military and some civilian personnel participated as volunteers in tests involving the use of chemical agents. Most of the work in the CB area during the past twenty years has been done with simulants, but in some cases chemical agents, sometimes diluted, have been used. Exposures of human subjects have generally fallen into three categories as outlined below:

a. Tests Related to Equipment Development.

In these tests, human subjects protected with prototype clothing, conduct military operations in the presence of a simulant, in an attempt to verify that the equipment will meet the operational need. Actual agents are used only when it is necessary to test detection or decontamination equipment. There is no direct application of agent to human subjects.

b. Testing of Protective Drugs and Therapy Regimes.

New prophylactic or therapy measures are first tested for safety by extensive comparative toxicology using animals and cell systems. Subsequently, human volunteers are exposed to ensure freedom from side effects. These tests do not involve the use of agents, and are aimed at testing the pharmacokinetics and side effects of the drugs in question. The established procedures followed by medical and pharmaceutical agencies for human testing with any drug are used. Health and Welfare Canada is the approving authority. The Surgeon General of the Canadian Forces is also consulted before such tests are undertaken. The current plan to carry out human testing of the oxime HI-6 (for defence against nerve agents) by a commercial laboratory is an example of this type of test.

c. Testing the Effects of Agents on Humans.

DRES has from time to time used small quantities of agent on human test subjects (volunteers, usually the scientists carrying

out the research) in order to establish the level at which agents had no effect, with a view to defining the real hazard that certain types of agent constitute when they are used on human subjects. These tests were undertaken to develop data which could not be obtained from animal models or through use of simulants.

15. In examining the human exposure records, it is evident that attitudes and approaches used have dramatically changed since the early work in the immediate post war period. Currently, exposure plans are submitted to a human ethics committee which must approve all experiments using human subjects. In addition, there is a major effort made to use either animals or simulants for the majority of experiments, and humans are only used where there is no practical alternative. The guidelines used by the ethics committee at DRES when reviewing plans for such tests are those recognized by the Canadian Medical Association regarding the participation of human volunteers in research programs.

16. It should be noted that on the direction of the Minister of National Defence, a special telephone number was established in September 1988 to allow any person involved in chemical defence test programs, during World War II or afterwards, to request a medical examination, if desired. The Department of Veterans' Affairs has undertaken to examine the cases of any of the World War II volunteers who request a review of their records.

ORGANIZATION, DEFENCE RESEARCH ESTABLISHMENT OTTAWA

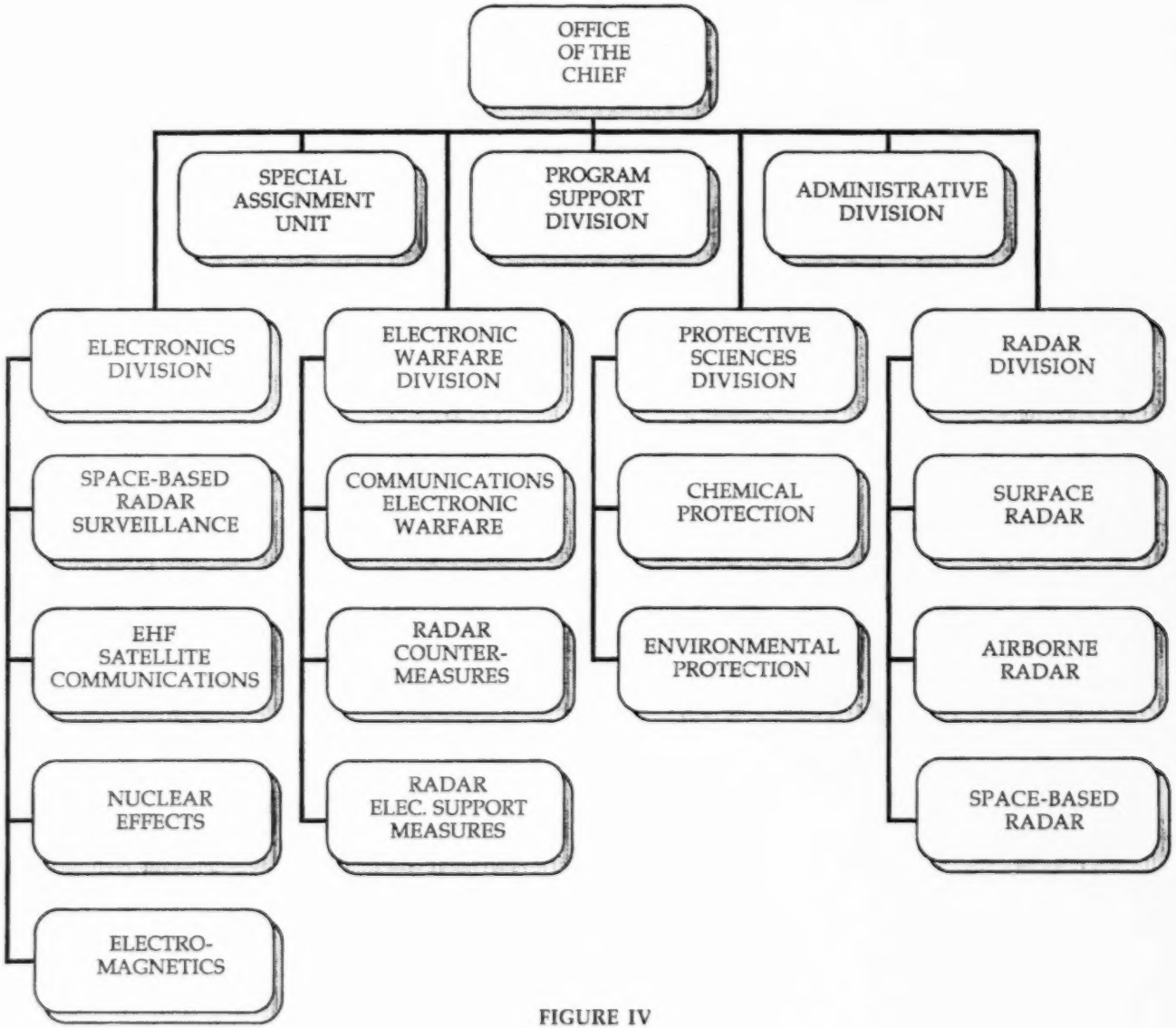
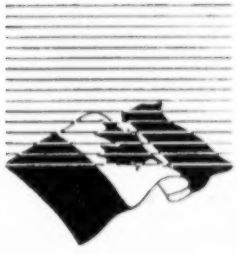


FIGURE IV

APPENDIX G

DEFENCE RESEARCH ESTABLISHMENT OTTAWA (DREO)



BACKGROUND

1. The Defence Research Establishment Ottawa (DREO) is located west of Ottawa at Shirley Bay. The laboratory had its origins in the Chemical Warfare Laboratories operated by the Canadian Army during World War II. In 1947 the name was changed to Defence Research Chemical Laboratories and the organization became one of the laboratories of the newly formed Defence Research Board of Canada (DRB). It moved to its present site in 1953. After two name changes in the nineteen-sixties to reflect the changing responsibilities, the laboratory became DREO in 1969, in line with name changes for all DRB laboratories. In 1974, control of DREO and the other laboratories was transferred to the Assistant Deputy Minister (Materiel) of the Department of National Defence, with overall control exercised through the Chief of Research and Development at National Defence Headquarters (NDHQ).

2. Although DREO was responsible originally for chemical defence work only, it soon began work in other technology areas. Over the years, electronics technology, arctic research, electrochemical research, power sources research, and communications and radar studies have been, or have become important components of the DREO scientific program, and the size of the chemical defence program has decreased. There are now four scientific divisions at DREO — Electronics Division, Electronic Warfare Division, Radar Division, and Protective Sciences Division (PSD) which houses the chemical defence work. DREO employs just over 200 civilian scientific, technical, and support staff and has 13 military personnel. Less than 20 percent of the staff work on the chemical defence program.

3. Until quite recently the PSD comprised four sections, namely Chemical Detection and Decontamination Section (CDDS), Chemical Protection Section (CPS), Environmental Protection Section, and Nuclear Effects Section. However, the latter is now part of Electronics Division and with the transfer in the past year of responsibility for detection and decontamination to Defence Research Establishment Suffield (DRES), CDDS has been disbanded. Hence the PSD now comprises two sections, and CPS is responsible for the DREO chemical defence program although it collaborates actively with the Environmental Protection Section in some areas, and the two sections share some test laboratories.

4. The overall objective of the current work of the CPS is to provide the Canadian Forces with individual protective equipment which will protect them against the effects of CB agents, and will have the least possible detrimental effect on their ability to perform their military duties.

5. The objective is pursued through a vigorous research and development program conducted both in-house and by means of work contracted to Canadian industry, universities, and the Royal Military College. The section also carries out

sponsored tasks related to chemical protection for engineering directorates at NDHQ.

6. The CPS comprises five groups, namely Materials Development, Materials Chemistry, Polymer Research, Engineering Development, and Chemistry. The latter group is a recent addition to the section to provide expertise in certain areas such as organic chemical synthesis, previously available through the CDDS. The work of the other four groups covers three general areas of materials chemistry. Included is work with adsorbents and toxic agents, materials development, which focuses on the interaction of agents with new materials, including materials developed for their potential protective capabilities, and engineering development, with special emphasis on protective clothing and equipments that will provide major improvements over existing items used by the CF. An outstanding example of such a development is the recent successful completion of a major project to develop a new protective mask, the C4, for the CF. Other CPS achievements pertaining to protective equipment include the development of a new gas mask canister (C2), a light-weight chemical resistant glove, a chemical defence ventilator for aircrew, and charcoal impregnated paper. CPS is currently working, or plans to work in future, on a new respirator for aircrew, next generation CB protective clothing, new concepts for gloves, new canister concepts, and new adsorbents for CB agents.

PHYSICAL SECURITY ISSUES

7. All the establishment's buildings are located on a site owned by the Department of Communications (DOC), and physical security of the site is the responsibility of that department. It is fenced and DOC security staff control access 24 hours a day. Chemical agents are stored in only two of these buildings. One is a small, specially-built, concrete block structure that has temperature controls and an alarm system. This building is kept locked and is surrounded by a fence with a padlocked gate. Access to this area and to the storage building is confined to a very small number of individuals.

8. The main DREO building has an electronic access control system. One wing of this building is used exclusively for chemical defence work, and internal access to the area is also regulated. There are further security controls on the small quantity of chemical agents stored there. Other hazardous chemicals, many of which are commercially available, are not stored with the chemical agents but are given the safe storage required by good laboratory practice.

REASONS FOR CONDUCTING TESTS WITH TOXIC AGENTS

9. There are several reasons why tests involving toxic agents are carried out in the CPS. They include: testing of the protection given by candidate materials or equipment; understanding the mechanisms and processes by which chemical agents penetrate materials such as clothing, rubber and plastics; support for the Quality Engineering Test Establishment of DND; and support for Canadian industry (which lacks facilities to carry out work with chemical agents) in testing products.

USES OF CHEMICAL AGENTS

10. Chemical agents are used in the CPS for two principal purposes — to test clothing and other materials such as rubbers and polymers, and to test gas mask canisters. In addition, small amounts of nerve agents are required to support Canadian industry in the production of CB defence equipment, for example detector paper. Nearly all clothing testing involves mustard agent, usually in the form of extremely small drops. Nerve agent is occasionally required as final qualification in materials testing. Canister testing requires primarily hydrogen cyanide, cyanogen chloride, phosgene, and chloropicrin; other industrial chemicals and chemical agent simulants may be used occasionally. Nerve agents are not used to test canisters. Simulants are used for any testing to assess protection against biological agents (and nuclear fallout).

INVENTORY OF CHEMICAL AGENTS

11. The chemical agent stock held at DREO and the projected future requirements were reviewed and deemed reasonable.

12. Since the chemicals required for canister testing are commercial products, there is no need to keep stocks on hand beyond the amounts needed to satisfy the immediate requirement.

13. It should be noted that there are no biological agents at DREO.

ENVIRONMENTAL CONSIDERATIONS OF CPS ACTIVITIES

14. All experiments with toxic chemicals are carried out in fume hoods in equipment that contains the agent. Even if release in the hood should occur, no toxic chemicals are discharged into the outside atmosphere because fume hoods are fitted with activated charcoal filters (as required by the Department of Labour for work

involving Class A poisons) and provide 100 per cent containment. Furthermore, the quantities of agents used are in general so small that physiologically active concentrations could not be released even if there were no filters on the hoods.

15. Any toxic waste that results from CPS work is detoxified using well established methods, and is then removed by a waste disposal contractor (Mosaic).

SAFETY CONSIDERATIONS

16. DREO has a health and safety committee, together with a sub-committee on emergency procedures, an up-to-date safety manual, and there is a Health and Welfare Canada nurse on-site, with a direct telephone line to CPS. The National Defence Medical Centre in Ottawa and the Directorate of Preventive Medicine at NDHQ supply specialized support equipment, and are available for medical response if necessary and for consultation and advice. Employees who work with chemical agents have annual medical check-ups.

17. A notable feature of the toxic wing of the main DREO building is that the corridors are maintained at a higher pressure than the laboratories, which in turn are at a higher pressure than the exterior. This arrangement ensures that if a toxic agent is spilled or inadvertently released in a laboratory, toxic vapours could not be dispersed in the building, and all agent would be exhausted through the fume hood filters, even if the fume hood fans fail.

18. Within the toxic wing, respirators, approved by the Canadian Standards Association, and self-contained breathing apparatus are available in strategic locations. Emergency cabinets contain protective clothing and various decontaminants. There is a gas alarm system, which would be activated, for example, in the event of a spill of chemical agent, and drills are held regularly.

19. Many laboratories in the CPS have been newly renovated and are equipped with high quality fume hoods (Kewaunee Class A), many of which have airflow meters. An alarm sounds should airflow fall to an unsafe level. A daily log of airflows is kept. The fume hoods are equipped with call buttons so that a person can summon help if necessary (for example in a situation that would not warrant activating the main gas alarm). All fume hoods have emergency power back-up, as do the freezers.

SUMMARY

20. The research and development activities of the Chemical Protection Section at DREO are concerned with protection of the individual against the effects of CB agents — both those that could be used now against Canadian military personnel, and those which might be used in future. The work covers a wide area and includes protective masks, gloves, clothing, boots and other items. It deals with such questions as the deficiencies, if any, in current protective equipment and how any deficiencies could be remedied, the use of new materials in protective equipment, the development of new methods to test and evaluate clothing and materials, and the development of protective equipment to meet the future needs of the CF. Sometimes the questions of how equipment can be produced more expeditiously and at lower cost are considered.

OGANIZATION, CANADIAN FORCES NUCLEAR BIOLOGICAL AND CHEMICAL SCHOOL

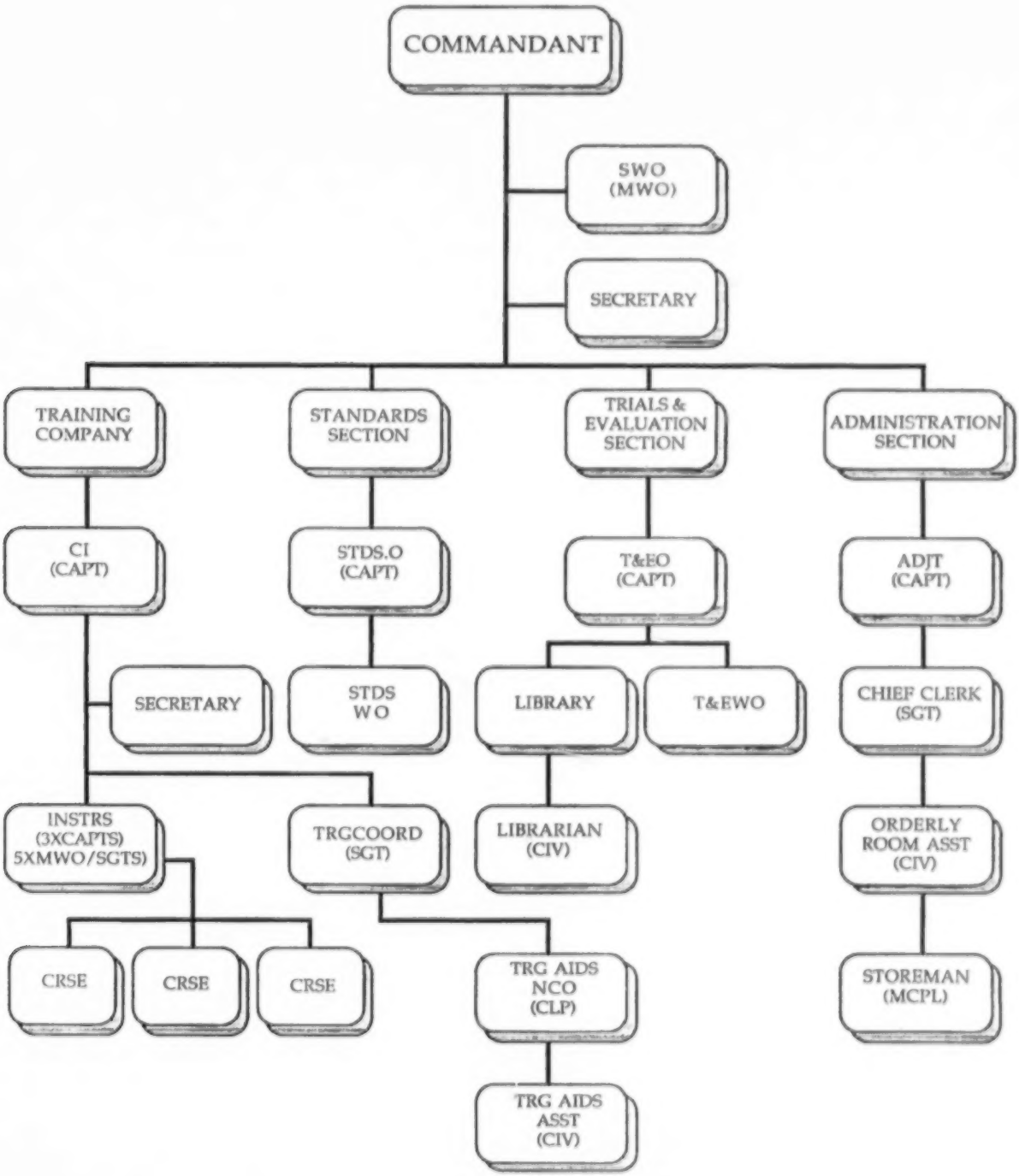


FIGURE V

CHEMICAL AND BIOLOGICAL DEFENCE TRAINING IN THE CANADIAN FORCES

BACKGROUND

1. In the Canadian Forces, chemical and biological defensive training deals with three separate areas. They are detailed below:

a. Recruit and Basic Officer Training.

All recruits and young officers go through an introduction to CB defence during their basic training. This includes an introduction to the protective clothing and a trip to the gas chamber to confirm the fit of the NBC (nuclear, biological chemical) Protective Mask and to practise basic individual protection drills. Tear gas (CS), is used in these exercises and the training represents only a small part of the overall recruit or basic officer course.

b. Unit and Collective Training.

In units and at bases each individual should be given a refresher annually on the basic individual skills necessary to survive and to fight on a contaminated battlefield. In addition, many ships and units participate in unit, ship or formation exercises which include some CB defence training. These exercises vary in length and scope and are tailored to the special environment being exercised. Most of these exercises use only the tear gas, CS, but occasionally other simulants for chemical agents are used. Very occasionally, some of these exercises have been conducted at CFB Suffield, and have been used for user tests of new equipment. On these occasions, chemical agents have sometimes been used.

c. Training at Canadian Forces Nuclear Biological and Chemical School (CFNBCS).

The CFNBCS trains instructors in NBC defence for all elements of the Canadian Forces. Its principal function is to train personnel who provide the detailed instruction at all bases, stations and units in the CF. In addition, it trains a small number of NBC staff officers who provide advice and assist in planning at senior headquarters.

2. Except for special exercises conducted at CFB Suffield, all training exercises use only simulants or the riot control agent, CS. This is a tear gas which is used by most police forces. Some of the simulants which have been used in the past can constitute a minor hazard if used in an inappropriate manner, but when they are used it is always under the supervision of skilled personnel from DRES and medical help is always available.

ROLE AND TASK OF CFNBCS

3. The majority of NBC training in the Canadian Forces, and the most intensive training, is done at CFNBCS, a part of CFB Borden, located about 100 km north of Toronto. It should be

noted that this school does nuclear protective training as well as chemical and biological protective training and most courses offered include a nuclear phase as well as a CB defensive phase.

The CFNBC School has three roles:

a. Training of NBC Instructors and Staff Officers.

This is the principal role of the school and it consumes the majority of staff time. The school, at its present strength, has the capacity to train about 750 students annually, but recent annual course loads have been about 500. The school has a strength of 20 military and 5 civilian personnel. A list of courses offered is at the end of this Appendix.

b. Conducting Minor Trials.

In addition to its training role, the School has a small trials section which does minor trials of NBC defensive equipment. Only simulants are used in such trials, the purpose of which is usually to develop a procedure or drill for the use of new equipment.

c. Provision of the NBC Response Team.

In the event of the use of a chemical, biological or radiological agent by a terrorist or other criminal element, DND may be asked to assist other government departments, provincial or municipal governments. The CFNBCS provides an immediate response team to meet this task.

4. The organization of the CFNBCS is outlined in Figure V. Organizationally, the school reports to the Commander of CFB Borden, and through him to Canadian Forces Training System Headquarters in CFB Trenton. On special technical matters the school can consult directly with the appropriate authorities in National Defence Headquarters.

TRAINING AT CFNBCS

5. All tear gas filled munitions for use in training at the CFNBCS are treated as ammunition and stored and guarded in the same manner as ammunition. At the end of each practice, statutory declarations to the effect that participating troops retain no unused munitions are routinely taken. There have been no recent cases where chemical training munitions have been misused or stolen from CFNBCS.

6. Students on the NBC Staff Officers Course, about 20 annually, visit DRES and while there participate in a decontamination exercise using mustard gas. This is the only routine training exercise, and indeed only course where such an agent is used in the CF training system. This exercise is considered necessary to give senior officers who will be advising on CB defence issues confidence in their protective clothing and procedures. This exercise has never produced any casualties.

TRAINING ELSEWHERE IN THE CANADIAN FORCES

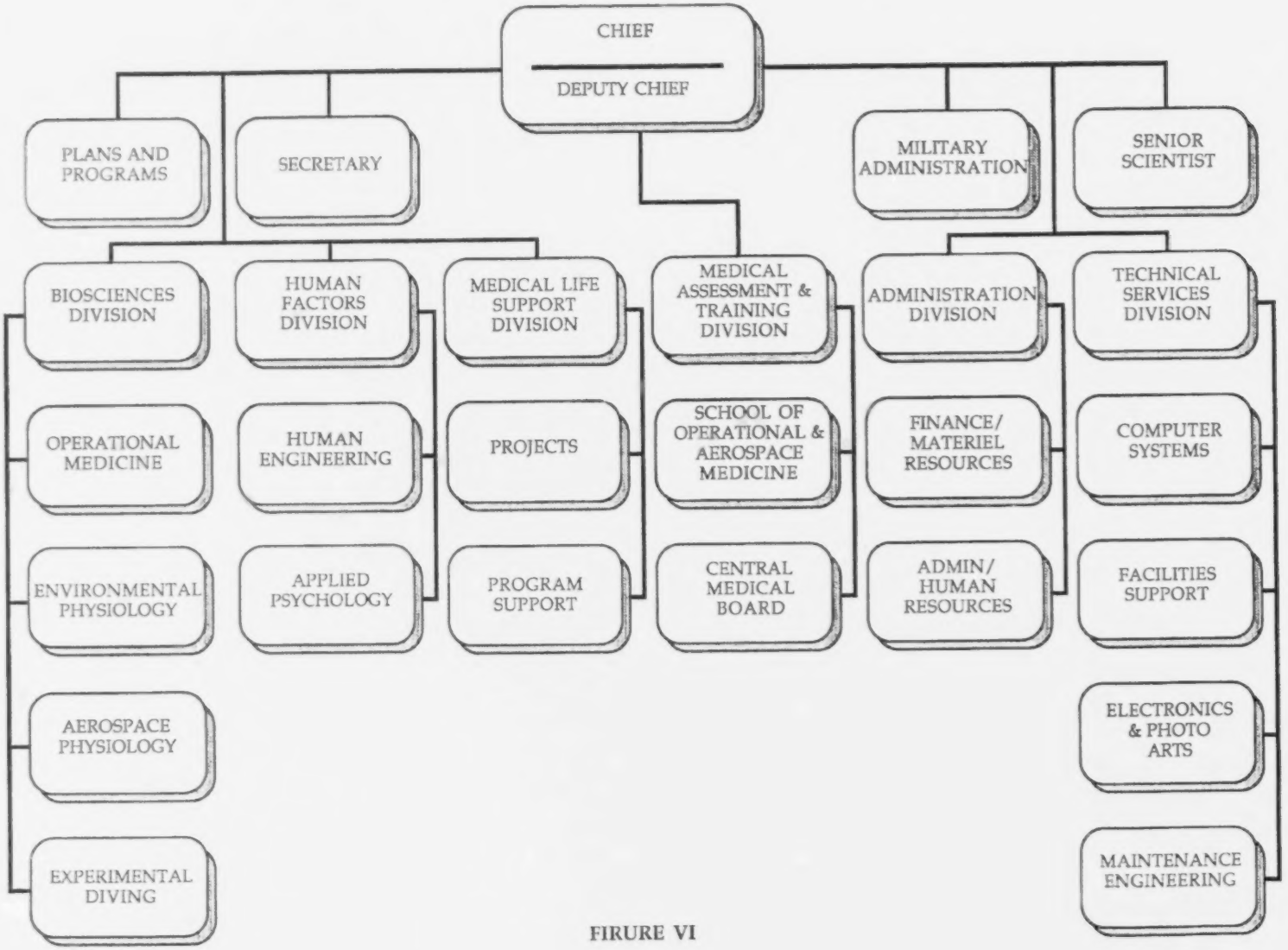
7. All training in CB defence is governed by regulations and guidance laid out in the pamphlet Operational Training, Volume 3, Ranges and Training Safety, Chapter 11 or in the series of pamphlets on NBC defence, Canadian Forces Publication (CFP) 316, Volumes 1 through 5.

8. Based on records available in DND only two incidents have taken place in the past two years which suggest the regulations governing the use of CS were not being followed, or that the controls were inadequate. In one incident, there was a complaint that tear gas had escaped the range area, and in another some tear gas capsules were missing from an armoury.

COURSES — CFNBCS

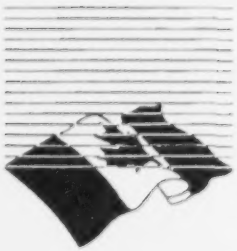
CODE	*TITLE*	*DURATION (TRG DAYS)*
AB	NBC STAFF OFFICER	62
4A	NBC SENIOR OFFICER	5
7A	NBC DEFENCE OFFICER/SUPERVISOR (SEA)	20
8A	NBC DEFENCE OFFICER/SUPERVISOR (LAND)	20
9A	NBC DEFENCE OFFICER/SUPERVISOR (AIR)	20
NV	NBC DEFENCE NCM - STATIC UNIT	20
NY	NBC DEFENCE NCM - MOBILE UNIT	15
AF/NE	RADIATION SAFETY OFFICER	22
AG	NER ON-SCENE CONTROL	5
AE/NC	NER RADIATION MONITOR	10
RDO	RADIOLOGICAL DEFENCE OFFICER (ARNPRIOR)	5
AZ/NF	NBC RESPONSE TEAM	5
	IN CONJUNCTION WITH CFMSS	
QQ	NBC DEFENCE - MEDICAL ASPECTS (OFFR)	13
NB	NBC DEFENCE - MEDICAL ASPECTS (NCM)	13

ORGANIZATION, DEFENCE AND CIVIL INSTITUTE OF ENVIRONMENTAL MEDICINE



FIRURE VI

THE DEFENCE AND CIVIL INSTITUTE OF ENVIRONMENTAL MEDICINE



INTRODUCTION

1. The Defence and Civil Institute of Environmental Medicine (DCIEM) is located in Metropolitan Toronto in the City of North York, and is one of twenty-two lodger units of Canadian Forces Base Toronto. The Institute comprises one main multipurpose laboratory building which also houses the administration, library and support services, and a newly-opened building dedicated to aerospace medicine and life support. As its name implies, the institute was intended to be responsible for defence related research as well as specialty components of civil sector research.

HISTORICAL BACKGROUND

2. DCIEM had its origins in the Interdepartmental Committee on Aviation Medicine Research formed in 1939 by the Department of National Defence, National Research Council and the Department of Transport.

3. At the outbreak of war, research on defence problems was organized under the National Research Council and the committee became the Associate Committee on Aviation Medical Research. During these years all three elements of the Canadian Armed Forces became deeply involved in scientific investigations and development. The RCAF laboratory was known as the Institute of Aviation Medicine (IAM) established in Toronto under the Associate Committee on Aviation Medical Research. This laboratory was the progenitor of the present-day DCIEM. During the war years the IAM had many notable achievements including the construction of the first human centrifuge on the Allied side, and Dr. Franks' pioneer work in the development of a Fluid-Filled Anti-G suit and a Demand Oxygen Regulator.

4. In 1947 the Defence Research Board was established to carry on in the post war era the defence research programs launched during the war. Included among the responsibilities assigned to the DRB was medical defence research, with primary emphasis on the occupational problems of the Armed Forces. This work was focused upon studies of the capabilities and limitations of the fit man, the environmental factors and hazards which affected him, and the tasks which he must perform in order to enhance his performance capability.

5. In late 1949, an agreement was reached with the RCAF that saw the DRB assume responsibility for the research formerly carried on by the IAM. The IAM retained its responsibilities for development, aviation medical training, medical statistics and clinical aviation medicine.

6. In 1950, the Defence Research Medical Laboratories (DRML) was established. One aspect of military medical research moved to this newly formed establishment, was concerned with toxicological problems, and a toxicology section of DRML was formed. Although this section had a primary responsibility to investigate toxicological problems associated with occupational health,

toxicological research of new chemical agents was also carried out. When DRML occupied its new laboratory in 1954, toxicology laboratories were included in the structure and fume hoods plus a ventilation exhaust were installed to permit some chemical research to be conducted. Subsequently, the responsibility for the activity was transferred to DRES and DREO.

7. In 1968, DRML was renamed the Defence Research Establishment Toronto (DRET) while its counterpart in the RCAF, the IAM, became the Canadian Forces Institute of Environmental Medicine (CFIEM) to reflect the unification of the Canadian Forces. In 1971, the CFIEM and DRET were amalgamated to form the present DCIEM.

8. As the result of DCIEM's heritage and to capitalize on the unique nature of this military/civilian mixture, the Canadian Forces Environmental Medical Establishment (CFEME) was created to function within the structure of DCIEM. The present organization of DCIEM consists of a civilian chief and a military deputy chief. The deputy chief is also the commanding officer of the CFEME for military career matters. In all other respects DCIEM is a truly integrated military/civilian establishment.

PRESENT PROGRAM AS IT RELATES TO CB DEFENCE

9. The mission of DCIEM is to conduct research and development to provide training and environmental medical expertise to ensure that the human can function effectively in all environments and in any man/machine system in use by the Canadian Forces.

10. Some parts of the DCIEM program include research activities which are related to defence against chemical and biological agents.

a. Aviation Life Support Systems. In the development of equipment to overcome the stresses of the aviation environment, such as extreme gravitational forces and high altitude it is necessary to ensure that the resultant systems will also offer protection against CB agents. This is accomplished by obtaining the advice of DREO on materials and devices which provide protection against CB agents, integrating these into Aircrew Protective Equipment and having the equipment evaluated for protection by use of simulants or CB agents by DRES.

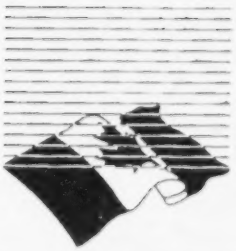
b. Operational Medicine. Research within this area includes advanced biochemical and immunological research in the field of liposomes (artificial bio-compatible cells composed of lipid material). This research is presently exploring the application of liposomes to entrap drugs, enzymes or antibodies and deliver them to vital vulnerable target sites in the human body (e.g. the eyes or the lungs). Initial studies have shown that the liposomal entrapment of a vital enzyme, acetylcholinesterase, is useful in offering prophylactic protection to the eye against miosis (contraction of the pupil) caused by a compound similar to a nerve agent. The same principle is being applied to the surface of the lung in an attempt to provide protection against inhaled noxious agents. This technology is being transferred to DRES for incorporation into its chemical defence program.

11. DCIEM makes major use of the human as the principal test subject, and has played a leading role in establishing safe ethical procedures for the use of human volunteers in experimental situations. The standards which they comply with are set out by: the Declaration of Helsinki, "Recommendations Guiding Doctors in Clinical Research", adopted by the World Medical Association in 1964; "Guidelines for Clinical Investigation" published by the American Medical Association; the "Ethics in Human Experimentation" published by the Medical Research Council of Canada in 1978, and "The Code of Ethics" approved by the Canadian Medical Association in June 1975.

SECURITY

12. DCIEM has no special physical security problems. Steps are being taken to implement perimeter security, and all required physical barriers are in place. No chemical or biological agents are used at DCIEM.

THE CANADIAN ENVIRONMENTAL PROTECTION ACT



The full title of the legislation is "An Act respecting the protection of the environment and of human life and health", which clearly defines the purpose of the statute. Also, the Declaration of the Canadian Environmental Protection Act states that "the protection of the environment is essential to the well-being of Canada", underscoring the importance placed by the Government of Canada on the concept of environmental protection.

KEY ELEMENTS

The Canadian Environmental Protection Act has the following elements:

- authority to control the introduction into Canadian commerce of substances that are new to Canada;
- authority to obtain information on and to require testing of both new substances and substances already existing in Canadian commerce;
- provisions to control all aspects of the life cycle of toxic substances from their development, manufacture or importation, transport, distribution, storage and use, their release into the environment as emissions at various phases of their life cycle, and their ultimate disposal as waste;
- authority to regulate fuels and components of fuels;
- authority to regulate emissions and effluents, as well as waste handling and disposal practices of federal departments, boards, agencies and Crown corporations;
- provisions to regulate federal works, undertakings and federal lands and waters, where existing legislation administered by the responsible federal department or agency does not provide for the making of regulations to protect the environment;
- provisions to create guidelines and codes for environmentally sound practices as well as objectives setting desirable levels of environmental quality;
- provisions to control sources of air pollution in Canada where a violation of an internal agreement would otherwise result, or where the air pollution affects another country and reciprocal legislation to control the source of the pollution exists;
- provisions to control nutrients, such as phosphates, in water conditioners or cleaning products, including detergents which can interfere with the use of waters by humans, animals, fish or plants;
- provisions to issue permits to control dumping at sea from ships, barges, aircraft and man-made structures (excluding normal discharges from off-shore facilities involved in exploration for, exploitation and processing of seabed mineral resources), and
- authority to sign agreements with provincial governments* regarding administration of the Act.

CONTEXT

Protection of the environment is a responsibility shared by all levels of government as well as by industry, organized labour and individuals. For this reason, the Canadian Environmental Protection Act gives the Minister of Environment the authority to conclude, with the approval of the Governor in Council, agreements with provincial governments concerning the administration of the Act.

In addition, the legislation allows the Governor in Council, upon recommendation of the Minister of Environment, to recognize, by order, provincial requirements as equivalent to regulations promulgated under the Canadian Environmental Protection Act. The Act also requires the Minister to enter into agreements with the provinces whose requirements are recognized as equivalent provisions. This means that the province will apply its equivalent requirements, rather than the national regulation made under the federal Act.

For the recommendation to the Governor in Council, specific criteria will be used to determine equivalency. The factors to establish equivalency will include:

- equal level of control as sanctioned by law;
- comparable compliance measurement techniques;
- comparable enforcement policies and procedures that are consistent with this Enforcement and Compliance Policy; and
- comparable rights of individuals, resident in Canada, to request investigation of a suspected offence and to receive a report of the findings.

In the annual report to Parliament on administration of the Canadian Environmental Protection Act, the Minister is required to include a specific accounting of the administration of federal-provincial agreements for implementation of the Act, including those covering enforcement of equivalent provincial requirements. Agreements will ensure that provinces enforcing all or any part of the statute or their equivalent provisions, do so in a manner consistent with this policy. In addition, the agreements will spell out procedures for measuring performance.

** The term "provincial governments" or "provinces" includes territories as provided in the federal Interpretation Act.*